Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune 5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Framework of Syllabus

For

T.Y.B. Sc. (Computer Science)

Choice Based Credit System (CBCS) Syllabus
Under National Education Policy (NEP)

To be implemented from Academic Year 2024-2025

Level:- 4.5 (First Year) Sem : I

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	ESE	Total
Subject 1 T(2)+ (T/P) (2) or T(4)	24CsCmpU1101	Programming in 'C'	2		2		20	30	50
	24CsCmpU1102	Lab Course on 24CsCmpU1101		2		4	20	30	50
Subject 2 T(2)+ (T/P) (2) or T(4)	24CsMatU1201	Discrete Mathematics	2		2		20	30	50
	24CsMatU1202	Lab Course on 24CsMatU1201		2		4	20	30	50
Subject 3 T(2)+ (T/P) (2) or T(4)	24CsEleU1301	Basics of Electronics Components and Circuits	2		2		20	30	50
	24CsEleU1302	Lab course on 24CsEleU1301		2		4	20	30	50
IKS T(2)	24CpCopU1901	Generic IKS	2		2		20	30	50
GE/OE (T/P) (2)	24CsCopU1401	Computer Fundamentals	2		2		20	30	50
SEC (P) (2)	24CsStaU1601	Lab Course on Statistical Analysis using R Programming I		2		4	20	30	50
AEC T(2)	24CpCopU1701 / 24CpCopU1702	MIL-I (Hindi) / MIL-I (Marathi)	2		2		20	30	50
VEC T (2)	24CpCopU1801	Environmental Science	2		2		20	30	50
Total			14	08	14	16			550

Level:- 4.5 (First Year) Sem : II

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	ESE	Total
Subject 1 T(2)+ T/P(2) or T(4)	24CsCmpU2101	Advanced 'C' Programming	2		2		20	30	50
	24CsCmpU2102	Lab Course on 24CsCmpU2101		2		4	20	30	50
Subject 2 T(2)+ P(2)	24CsMatU2201	Matrix Theory	2		2		20	30	50
	24CsMatU2202	Lab Course on 24CsMatU2201		2		4	20	30	50
Subject 3 T(2)+ P(2)	24CsEleU2301	Basics of Electronic Instrumentation	2		2		20	30	50
	24CsEleU2302	Lab course on 24CsEleU2301		2		4	20	30	50
GE/OE (T/P) (2)	24CsCopU2401	Digital Marketing	2		2		20	30	50
SEC P(2)	24CsStaU2601	Lab Course on Statistical Analysis using R Programming II		2		4	20	30	50
AEC T(2)	24CpCopU2703	English Communication Skills I	2		2		20	30	50
VEC T(2)	24CpCopU2801	Democracy, Election and Governance	2		2		20	30	50
CC (2)	24CpCopU2001/ 24CpCopU2011 / 24CpCopU2021 / 24CpCopU2031 / 24CpCopU2041 / 24CpCopU2051 / 24CpCopU2061 / 24CpCopU2071	Physical Education / Cultural Activities / NSS / NCC / Fine Arts / Applied Arts / Visual Arts / Performing Arts	2		2		20	30	50
Total			14	08	14	16			550

Level:- 5.0 (Second Year) Sem:III

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	ESE	Total
Major Core T(2+2 or 4), (T/P)(2)	24CsCmpU3101	Data Structures	2		2		20	30	50
	24CsCmpU3102	Database Management System	2		2		20	30	50
	24CsCmpU3103	Lab Course on 24CsCmpU3101 and 24CsCmpU3102		2		4	20	30	50
VSC P(2)	24CsCmpU3501	Lab Course on Scripting Languages		2		4	20	30	50
IKS (T/P)(2)	24CsCopU3901	Vedic Mathematics and Computer Fundamentals	2		2		20	30	50
FP P(2)	24CsCmpU3002	Field Project I		2		4	20	30	50
Minor (T/P) (2+2 or 4)	24CsEleU3301 / 24CsMatU3301	Intel 8051 and Raspberry Pi / Advanced Discrete Mathematics	2		2		20	30	50
	24CsEleU3302 / 24CsMatU3302	Lab Course on 24CsEleU3301 / Lab Course on 24CsMatU3301		2		4	20	30	50
GE/OE (T/P) (2)	24CsCopU3401	Cyber Security	2		2		20	30	50
AEC T(2)	24CpCopU3703	English Communication Skills II	2		2		20	30	50
CC T(2)	24CpCopU3001	Online Course on Yoga	2		2		20	30	50
Total			14	08	14	16			550

Level:- 5.0 (Second Year) Sem:IV

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	ESE	Total
Major Core T(2+2 or 4), (T/P)(2)	24CsCmpU4101	Advanced Data Structures	2		2		20	30	50
	24CsCmpU4102	Advanced Database Management System	2		2		20	30	50
	24CsCmpU4103	Lab Course on 24CsCmpU4101 & 24CsCmpU4102		2		4	20	30	50
VSC P(2)	24CsCmpU4501	Lab Course on OOP using C++		2		4	20	30	50
CEP P(2)	24CpCopU4003	Community Engagement Project		2		4	20	30	50
Minor (T/P)(2+2 or 4)	24CsEleU4301 / 24CsMatU4301	Analog and Advanced Digital Communication / Groups and Coding Theory	2		2		20	30	50
	24CsEleU4302 / 24CsMatU4302	Lab Course on 24CsEleU4301 / Lab Course on 24CsMatU4301		2		4	20	30	50
GE/OE (T/P) (2)	24CsCopU4401	Web Designing	2		2		20	30	50
SEC T(2)	24CsStaU4601	Data Mining	2		2		20	30	50
AEC T(2)	24CpCopU4701 / 24CpCopU4702	MIL-II (Hindi) / MIL-II (Marathi)	2		2		20	30	50
CC T(2)	24CpCopU4001	Health and Wellness	2		2		20	30	50
Total			14	08	14	16			550

Level:- 5.5 (Third Year) Sem:-V

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	ESE	Total
Major Core T(2+2+2+2 or 4 + 2+2 or 4 + 4) P(2+2 or 4)	24CsCmpU5101	System Programming	2		2		20	30	50
	24CsCmpU5102	Programming in Core Java	2		2		20	30	50
	24CsCmpU5103	Object Oriented Software Engineering	2		2		20	30	50
	24CsCmpU5104	Theory of Computer Science	2		2		20	30	50
	24CsCmpU5105	Lab Course on 24CsCmpU5101		2		4	20	30	50
	24CsCmpU5106	Lab Course on 24CsCmpU5102		2		4	20	30	50
Major Elective (T/P) (2+2 or 4)	24CsCmpU5201	Android Programming	2		2		20	30	50
	24CsCmpU5202	Lab Course on 24CsCmpU5201		2		4	20	30	50
	OR								
	24CsCmpU5203	Software Testing	2		2		20	30	50
	24CsCmpU5204	Lab Course on 24CsCmpU5203		2		4	20	30	50
	OR								
	24CsMatU5205	Numerical Methods	2		2		20	30	50
	24CsMatU5206	Lab Course on 24CsMatU5205		2		4	20	30	50
	OR								
	24CsEleU5207	Embedded System	2		2		20	30	50
	24CsEleU5208	Lab course on 24CsEleU5207		2		4	20	30	50
VSC P(2)	24CsCmpU5501	Lab Course on Web Technology		2		4	20	30	50
FP (2)	24CsCmpU5001	Field Project II		2		4	20	30	50
Minor (T/P) (2)	24CsMatU5301	Lab course on Operations Research		2		4	20	30	50
	OR								
	24CsEleU5302	Lab Course on Embedded System and IoT		2		4	20	30	50
Total			10	12	10	24			550

Level:- 5.5 (Third Year) Sem:-VI

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	ESE	Total
Major Core T(2+2+2+2 or 4+2+2 or 4+4) P(2+2 or 4)	24CsCmpU6101	Operating System Concepts	2		2		20	30	50
	24CsCmpU6102	Programming in Advanced Java	2		2		20	30	50
	24CsCmpU6103	Computer Networks	2		2		20	30	50
	24CsCmpU6104	Foundation of Data Science	2		2		20	30	50
	24CsCmpU6105	Lab Course on 24CsCmpU6101		2		4	20	30	50
	24CsCmpU6106	Lab Course on 24CsCmpU6102		2		4	20	30	50
Major Elective (T/P) (2+2 or 4)	24CsCmpU6201	Big Data Analytics	2		2		20	30	50
	24CsCmpU6202	Lab Course on 24CsCmpU6201		2		4	20	30	50
	OR								
	24CsCmpU6203	C# DOT NET	2		2		20	30	50
	24CsCmpU6204	Lab Course on 24CsCmpU6203		2		4	20	30	50
	OR								
	24CsMatU6205	Computational Geometry	2		2		20	30	50
	24CsMatU6206	Lab Course on 24CsMatU6205		2		4	20	30	50
	OR								
	24CsEleU6207	Wireless Sensor network and IOT	2		2		20	30	50
	24CsEleU6208	Lab course on 24CsEleU6207		2		4	20	30	50
VSC P(2)	24CsCmpU6501	Python Programming		2		4	20	30	50
OJT (2)	24CsCmpU6004	On Job Training		4		8	40	60	100
Total			10	12	10	24			550

Sem 5

1. **24CsCmpU5101 System Programming**
2. **24CsCmpU5102 Programming in Core Java**
3. **24CsCmpU5103 Object Oriented Software Engineering**
4. **24CsCmpU5104 Theory of Computer Science**
5. **24CsCmpU5105 Lab course on System Programming(24CsCmpU5101)**
6. **24CsCmpU5106 Lab course on Core Java (24CsCmpU5102)**

Major Elective

7. **24CsCmpU5201 Android Programming**
8. **24CsCmpU5202 Lab course on Android Programming**

Or

9. **24CsCmpU5203 Software Testing**
10. **24CsCmpU5204 Lab course on Software Testing (24CsCmpU5203)**

Or

11. **24CsMatU5205 Numerical Methods**
12. **24CsMatU5206 Lab course on 24CsMatU5205**

Or

13. **24CsEleU5207 Embedded System**
14. **24CsEleU5208 Lab course on 24CsEleU5207**

---

15. **24CsCmpU5501 Web Technology**
16. **24CsMatU5301 Operation Research**

Or

17. **24CsEleU5302 Lab course on Embedded system and IoT**

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune – 5

T.Y. B. Sc. (Computer Science)

(NEP 2024)

Course Code: 24CsCmpU5101
Course Name: System Programming

Teaching Scheme: TH: 2 Hours/Week **Credit: 2**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

Students should have basic knowledge of C Programming and Basic and Advanced Data structures .

Course Objectives:

- To understand the design and implementation challenges of system programs essential for program development.
- To explore various elements of the programming environment.
- To comprehend and design the structure of an assembler.
- To understand the structure and functionality of a macro preprocessor.
- To learn the fundamental working principles of compilers and types of interpreters.
- To learn the fundamental working principles of linkers and loaders.

Course Outcomes:
After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Differentiate between system programs and application programs.	1
CO 2	Explain various system programs, including Editors, Simulators, Assemblers, Macro Preprocessors, Compilers, Interpreters , Loaders, and Linkers.	2
CO 3	Design and implement system programs such as Editors, Simulators, Assemblers, and DFA drivers.	3
CO 4	Analyze the structure and working of Assemblers and Macro Processors.	4
CO 5	Evaluate the role of , Compilers and Interpreters, linkers and loaders in program execution.	5
CO 6	Develop various system programs.	6

Course Contents:

Unit 1	Introduction	8 lectures
	1.1 Types of program – System program and Application program. 1.2 Elements of Programming environment - Editor, Preprocessor, Assembler, Compiler, Interpreter, Linker and Loader, Debugger, Device drivers, Operating System. 1.3 Need/purpose of editor, Types of editor, structure of editor 1.4 Simulation of simple computer smac0 (hypothetical computer) -Memory, Registers, Condition Codes, Instruction format, Instruction Set, smac0 programs.	
Unit 2	**Assembler**	**12 lectures**
	2.1 Definition. 2.2 Features of assembly language, advantages 2.3 Statement format, types of statements – Imperative, Declarative, Assembler Directive. 2.4 Constants and Literals. 2.5 Design of assembler – Analysis Phase and Synthesis Phase. 2.6 Overview of assembling process 2.7 Pass Structure of Assembler – One pass, Two pass assembler. 2.8 Problems of 1-pass assembler - forward reference, efficiency, Table of Incomplete Instructions. 2.9 Design of 2-pass Assembler – Pass-I and Pass-II 2.10 Advanced assembler directives (LTORG, ORIGIN, EQU), 2.11Data structure of 2-pass assembler. 2.12 Intermediate Code – Need, Forms-variant I and Variant II	
Unit 3	**Macros and Macro Processors**	**4 lectures**
	3.1 Definition 3.2 Macro definition and call 3.3 Macro expansion – positional and keyword parameters 3.4 Nested macro calls 3.5 Advanced macro facilities – alteration of flow of control during expansion, expansion time variable, conditional expansion, expansion time loops. (with	

	examples)	
Unit 4	**Compilers and Interpreters**	**3 lectures**
	4.1 Definition, Aspects of compilation 4.2 The structure of Compiler Phases of Compiler – Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code generation, code optimization, code generation 4.3 Interpreter - Use of interpreter, definition, Comparison with compiler, Overview of interpretation, 4.4 Pure and impure interpreter. P-code compiler	
Unit 5	**Linker and Loader**	**3 lectures**
	5.1 Introduction 5.2 Concept of bindings, static and dynamic binding, translated, linked and load time addresses. 5.3 Relocation and linking concept – program relocation, public and external references, linking, Relocatability - non relocatable, relocatable, and self-relocating programs, Linking for Overlays.	

Reference Books:

1. Systems Programming and Operating Systems by D.M.Dhamdhere (Second Revised Edition). ISBN-10 **0074635794**.

2. System Software - An introduction to Systems Programming - Leland L. Beck (Pearson Education) ISBN-10. 0201423006

3. Compilers: Principles, Techniques and Tools – Aho, Lam, Sethi, Ullman (Second Edition) Pearson Education ISBN 978-9357054119

4. Linkers and Loaders – John R. Levine, Elsevier Moegan Kaufmann ISBN-10. 1558604960

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5

Third Year of B.Sc. (Computer Science)
(NEP 2024)

Course Code: 24CsCmpU5102
Course Name: Programming in Core JAVA

Teaching Scheme: 2 Lectures/Week **Credits: 2**
Examination Scheme: CIA : 20 Marks **End-Sem: 30 Marks**

Prerequisite:
Basic knowledge of Object Oriented Programming language

Course Objectives:

- To understand the fundamentals of Object-Oriented programming in Java
- To understand the concept and importance of Exception Handling
- To understand basic screen design with Swing
- To understand User Interface Components with Swing
- To understand features of JavaFX

Course outcomes:
On completion of the course, Students will be able to:

CO No.	Course Outcomes(COs)	Blooms Cognitive level
1	Recall and explore the basic syntax of Object Oriented Programming features	1
2	Demonstrate robust application using Core Java features	2
3	Implement basic GUI based application	3
4	Analyse the proficiency in Exception Handling	4
5	Evaluate and develop applications with File handling	5
6	Create interactive applications that leverage user input/output and visual interfaces, combining knowledge of Java and related libraries/frameworks.	6

Course Contents:

Unit No.	Title	Lectures
Unit 1	**An Introduction to Java**	**4**
	1.1 Overview of Java Concepts 1.1.1What Can Java Do? 1.1.2 Characteristics/Buzzwords of Java 1.1.3 Advantages and Disadvantages of Java 1.2 Comparison of Java and C++ 1.3 Java Environment and IDEs 1.4 Java Tools 1.4.1 jdb (Java Debugger) 1.4.2 javap (Class File Disassembler) 1.4.3 javadoc (Java Documentation Generator) 1.5 Data Types and Variables 1.6 Operators 1.7 Expressions, Statements, and Blocks 1.8 Control Flow Statements 1.9 Wrapper Classes 1.10 Writing a Simple Java Program	
Unit 2	**Usage of Input/ Output and File Handling**	**3**
	2.1 Basic I/O 2.1.1 Reading Input 2.1.2 Writing Output 2.2 File Handling	
Unit 3	**Objects and Classes**	**6**
	3.1 Defining Your Own Classes 3.2 Access Specifiers (public, protected, private, default) 3.3 Array of Objects 3.4 Constructor, Overloading Constructors and use of 'this' Keyword 3.5 Usage of static block, static fields and static methods 3.6 Inner class, anonymous class 3.7 Garbage Collection	
Unit 4	**Inheritance, Abstract class, Interface**	**4**
	4.1 Inheritance Basics 4.1.1 Understanding the 'extends' Keyword 4.1.2 Types of Inheritance 4.2 Usage of final Keyword and Abstract class 4.2.1 final with Methods 4.2.2 final with Classes 4.2.3 Abstract Classes and Abstract Methods 4.3 Interfaces	
Unit 5	**Exception Handling**	**5**
	5.1 Dealing with Errors and Exceptions 5.1.1 Understanding Errors vs. Exceptions 5.1.2 Common Causes of Exceptions	

	5.2 Exception Class and Types of Exceptions 5.2.1 The Exception Class Hierarchy 5.2.2 Checked Exceptions 5.2.3 Unchecked Exceptions 5.3 Exception Handling Blocks 5.3.1 try Block 5.3.2 catch Block 5.3.3 throw Keyword 5.3.4 throws Keyword 5.3.5 finally Block 5.4 Creating User-Defined Exceptions 5.4.1 Defining Custom Exception Classes 5.4.2 Throwing Custom Exceptions	
Unit 6	**User Interface Components with Swing, Introduction to JavaFX**	**8**
	6.1 Introduction to Swing 6.2 Understanding MVC (Model-View-Controller) Architecture 6.3 Usage of Layout Managers 6.3.1Flow Layout 6.3.2Border Layout 6.3.3 Grid Layout 6.4 Swing Components 6.4.1 JButton 6.4.2 JLabel 6.4.3 JTextField 6.4.4 JTextArea 6.4.5 JCheckBox 6.4.6 JRadioButton 6.4.7 JList 6.4.8 JComboBox 6.4.9 JMenu and JMenuItem 6.4.10 JPopupMenu 6.4.11 JCheckBoxMenuItem 6.4.12 JRadioButtonMenuItem 6.5 Event Handling in Swing 6.5.1 Event Sources 6.5.2 Mouse Events 6.5.3 Keyboard Events Event Listeners: ActionListener, MouseListener and MouseMotionListener. KeyListener 6.6.Introduction to JavaFX 6.6.1 What is JavaFX? 6.6.2 Key Features of JavaFX	

Reference books:

1. Java The Complete Reference - Eleventh Edition, Herbert Schildt, Tata Mc Graw Hill, ISBN-13 : 978-9390491629

2. Programming with Java | 6th Edition, E Balagurusamy, ISBN-13 : 978-9353162344
3. Core Java: Fundamentals, Volume I, 10th Edition, Cay S. Horstmann, Prentice Hall ISBN-13: 978-0134177304

Reference link:

https://docs.oracle.com/javase/8/

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune – 5

T.Y. B. Sc. (Computer Science)
(2024 Course under NEP)

Course Code: 24CsCmpU5103
Course Name: Object Oriented Software Engineering

Teaching Scheme: TH: 2 Hours/Week **Credit: 02**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Knowledge of Software Engineering practices

Course Objectives:

- To get knowledge and understanding of Object Oriented Software Engineering disciplines, practices and pedagogy.
- To learn Analysis, Design principles for Object Oriented Software Project Development.

Course Outcomes:
After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Understand and describe the basic principles of Software Engineering and Object-Oriented Software Engineering.	1
CO 2	Compare Object-Oriented Software Engineering with traditional software engineering approaches and identify key differences.	2
CO 3	Apply structural UML diagrams (e.g., class diagrams, object diagrams) to model system components and relationships.	3
CO 4	Analyze system behavior using sequence, activity, and state diagrams to evaluate and predict system performance and flow.	4
CO 5	Evaluate system architecture using component and deployment UML diagrams to assess the effectiveness of hardware and software deployment.	5
CO 6	Create UML diagrams from real-world case studies to represent complex systems and their behavior accurately.	6

Course Contents:

Unit 1	**Introduction to Object-Oriented Software Engineering**	**07 lectures**
	1.1 Overview of Software Engineering 1.2 Object-Oriented Software Engineering vs. Traditional Software Engineering 1.3 Object-Oriented Concepts: Abstraction, Encapsulation, Inheritance, Polymorphism 1.4 Software Development Life Cycle (SDLC) in Object-Oriented Context 1.5 Introduction to Unified Modeling Language (UML): Concept and advantages	
Unit 2	**UML Diagrams – Structural Modeling**	**07 lectures**
	2.1 Classes, attributes, operations, relationships (association, aggregation, composition, dependency, generalization) 2.2 Advanced Classes 2.3 Advanced Relationship 2.4 Interface 2.5 Class Diagram - Multiplicity 2.6 Object Diagram – Object instances and their relationships 2.7 Case study of each (Minimum Two)	
Unit 3	**UML Diagrams – Behavioral Modeling**	**10 lectures**
	3.1 Sequence Diagram – Interaction between objects over time (lifelines, messages, activation bars) 3.2 Use Case Diagram – Actors, use cases, relationships (include, extend, generalization) 3.3 Interaction Diagram 3.4 Activity Diagram – Workflow representation, decision nodes, swimlanes 3.5 State Diagram – States, transitions, events, initial & final states 3.6 Case study of each (Minimum Two)	
Unit 4	**UML Diagrams – Architectural Modeling**	**06 lectures**
	4.1 Collaboration Diagram – Object interactions represented as links between objects 4.2 Component Diagram – Software components, dependencies, interfaces 4.3 Deployment Diagram – Hardware and software deployment, nodes, artifacts 4.4 Case study of each (Minimum Two)	

Reference Books:

1. The Unified Modeling Language, User Guide by Grady Booch, James Raumbaugh, Ivar Jacobson, ISBN: 0321267974.
2. Object Oriented Software Engineering by Ivar Jacobson, ISBN: 9780201544350
3. Software Engineering by Roger S. Pressman, ISBN: 9780078022128
4. Applying UML and Patterns by Craig Larman, ISBN-10: 8177589792

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science)

(2024 Course under NEP)

Course Code: 24CsCmpU5104

Course Name: Theory of Computer Science

Teaching Scheme: TH: 2 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Sets, Operations on sets, Finite & infinite sets Formal Language
- Relation, Equivalence Relation,(reflexive, transitive and symmetric closures)

Course Objectives:

- To have an understanding of finite state and push down automata.
- To have a knowledge of regular languages and context free languages.
- To know the relation between regular language, context free language and corresponding recognizers.
- To study the Turing machine and classes of problems.

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Define basic concepts in formal language theory, grammars, automata theory and computability theory Explain the relationship among language classes and grammars with the help of Chomsky Hierarchy	1
CO 2	Apply mathematical and formal techniques for solving problems in computer science.	2
CO 3	Relate practical problems to languages, automata, computability, and complexity	3
CO 4	Demonstrate abstract models of computing, including deterministic (DFA), non-deterministic (NFA), Push Down Automata (PDA) and Turing (TM) machine models and their power to recognize the languages.	4

CO 5	Apply formal mathematical methods to prove properties of languages, grammars and automata.	5
CO 6	Model various kinds of real-time problems such as designing the compilers.	6

Course Contents

Chapter 1	**Introduction**	**1 lecture**
	1.1 Symbol, Alphabet, String 1.2 Prefix & Suffix of Strings 1.3 Formal Language 1.4 Operations on Languages	
Chapter 2	**FiniteAutomata**	**8 lectures**
	2.1 Deterministic finite Automaton – Definition, DFA as language recognizer, 2.2 Nondeterministic finite automaton – Definition and Examples. 2.3 NFA TO DFA : Method 2.4 NFA with ε- transitions Definition and Examples. 2.5 NFA with ε-Transitions to NFA without ε-Transitions &Examples 2.6 Finite automaton with output – Mealy and Moore machine, Definition and Examples. 2.7 Minimization of DFA, Algorithm & Problem using Table Method	
Chapter 3	**Regular Languages**	**4 lectures**
	3.1 Regular language-Definition and Examples. 3.2 Conversion of RE To FA-Examples. 3.3 Pumping lemma for regular languages and Applications	
Chapter 4	**Context Free Grammar and Languages**	**10 lectures**
	4.1 Grammar - Definition and Examples 4.2 Derivation-Reduction - Definition and Examples 4.3 Chomsky Hierarchy. 4.4 CFG: Definition & Examples. LMD, RMD, Parse Tree 4.5 Ambiguous Grammar: Concept & Examples. 4.6 Simplification of CFG: 4.6.1 Removing Useless Symbols 4.6.2 Removing unit productions 4.6.3 Removing ϵ productions & Nullable symbols 4.7 Normal Forms : 4.7.1 Chomsky Normal Form (CNF) Method & Problem 4.7.2 Greibach Normal form (GNF) Method &Problem	
Chapter 5	**PushdownAutomaton**	**4 lectures**
	5.1 Definition of PDA and examples	

	5.2 Construction of PDA using empty stack and final State method : Examples using stack method 5.3 Definition DPDA & NPDA, their correlation and Examples of NPDA	
Chapter 6	**Turing Machine**	**3 lectures**
	6.1 The Turing Machine Model and Definition of TM 6.2 Design of Turing Machines 6.3 Problems on language recognizers. 6.4 Language accepted by TM	

References:

1. John E. Hopcraft, Rajeev Motwani, Jeffery D. Ullman, "Introduction to Automata Theory, Languages & Computations", ISBN: 978-0321455369, Pearson publication, Third edition

2. K. L. P. Mishra, N. Chandrasekaran, "Theory of Computer Science", ISBN: 9788120329683,Published by Prentice-Hall of India Pvt.Ltd , Third edition.

3. Daniel A. Cohen, "Introduction to Computer Theory", ISBN: 978-0471137726, John Wiley &Sons; 2nd Revised edition edition.

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science)
(NEP 2024)

Course Code: 24CsCmpU5105
Course Name: Lab Course on 24CsCmpU5101: System Programming

Teaching Scheme: PR: 4 Hours/Week **Credit : 02**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- **C Programming**
- **Data Structures**

Course Objectives:

- Design and implement System programs with minimal features to understand their complexity

Course Contents:

Sr.No	**List of practical**
1	Line Editor
2	Simulator
3	Assembler
4	DFA driver

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5

Third Year of B.Sc. (Computer Science)
(NEP 2024)

Course Code: 24CsCmpU5106
Lab Course on 24CsCmpU5102: Programming in Core Java

Teaching Scheme: 2 Hours/Week in the Lab **Credits: 2**
Examination Scheme: CIA : 20 Marks **End-Sem: 30 Marks**

Prerequisites:

Knowledge of Object Oriented Programming

Course Objective:
To understand the process of designing and implementing applications with Core Java features.

Teaching Scheme:PR : 4 Hours/Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem : 30 Marks**

Sr. No.	Assignment Name
1.	Simple Java programs and File handling
2.	Objects, Classes and Packages
3.	Inheritance and Interfaces
4.	Exception Handling
5.	Strings, Streams, I/O and File Handling
6.	Usage of Swing components and Event Handling

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune – 5

T.Y. B. Sc. (Computer Science)
(NEP 2024)

Course Code: 24CsCmpU5201
Course Name: Android Programming(T+P) Major Elective

Teaching Scheme: TH: 2 Hours/Week **Credit: 2**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Knowledge of Java
- Basic knowledge of XML

Course Objectives:

- Understand the Android platform, architecture, and components.
- Design interactive user interfaces using XML and Android UI components.
- To learn to create Android Applications.

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Bloom's Cognitive Level
CO 1	Recall the fundamental concepts of Android programming, including components, Android architecture.	1
CO 2	Illustrate basic Android applications with various UI components and features like buttons, text fields, and images and event handling.	2
CO 3	Applying programming concepts in creating Android applications using event handling, activities, fragments and intents, services, broadcast receivers, threads.	3
CO 4	Analyze and troubleshoot Android applications to identify issues. Examine the life cycles of Activities and fragments.	4
CO 5	Determine use of Google Maps, SMS and multimedia in Android application	5
CO 6	Design and implement mobile applications involving data storage in SQLite database	6

Course Contents:

Unit 1	**Introduction to Android OS**	**No of lectures**
	1.1 What is Android 1.2 Features of Android 1.3 History and Versions 1.4 Android Architecture 1.5 Dalvik VM 1.6 Core Building Blocks	2
Unit 2	**Creating Android Application**	**No of lectures**
	2.1 Creating Android project 2.3 Project Structure 2.4 AndroidManifest.XML 2.5 Android Virtual Devices(AVDs) 2.6 Emulators	2
Unit 3	**Activities, Fragments and Intents**	**No of lectures**
	3.1 Introduction to Activities 3.2 Activity Lifecycle 3.3 Introduction to Intents and types 3.4 Linking Activities using Intents 3.5 Broadcast receivers 3.6 Using Intents to broadcast events 3.7 Introduction to Fragments 3.8 Lifecycle of Fragment 3.9 Threads and Services 3.10 Toast	10
Unit 4	**Building User Interfaces**	**No of lectures**
	4.1 Fundamentals of UI design • Views, View Groups, fragments, activities 4.2 Layout manager • Linear Layout • Relative Layout • Constraint Layout • Frame Layout: • Grid Layout: • Table Layout • Scroll View 4.3 Designing your user interface with views • Text View • Button, • Image Button, • Edit Text • Check Box • Toggle Button, • Radio Button, and Radio Group Views • ProgressBar • Auto Complete Text View	10

	• List View • Spinner • ImageView • Menus • Time Picker and Date Picker View • Dialogs	
Unit 5	**Databases – SQLite, Messaging, Location-Based Services and Multimedia**	**No of lectures**
	5.1 Introducing ANDROID databases: SQLite Databases and content providers 5.2 Introduction to SQLite 5.3 Working with SQLite • Building and executing queries 5.4 SMS telephony 5.5 Google Maps • Display Google Maps • Getting Location Data • Navigating to specific location 5.6 Multimedia • Play Audio and Video	5
1`Unit 6	**Experiential Learning**	**No of lectures**
	Building, testing, and deploying Android applications to gain practical, industry-ready skills.	1

Reference Books:

1. Head First Android Development, 3rd Edition by Dawn Griffiths, David Griffiths, O'Reilly Media,ISBN: 9781492076476
2. Android Programming for Beginners - Second Edition by John Horton, Packt Publishing ,ISBN 978-1789538502
3. Android by Prasanna Kumar Dixit, Vikas Publishing House,ISBN 9789325977884

Websites:

1. The official site for Android developers - https://developer.android.com
2. https://abhiandroid.com/
3. https://www.tpointtech.com/android-tutorial

MOOC Course link:

https://nptel.ac.in/courses/106106147

https://www.digimat.in/nptel/courses/video/106106147/L07.html(and next lessons)

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Shivajinagar, Pune – 5

T.Y. B. Sc. (Computer Science) (NEP 2024)

Course Code: 24CsCmpU5202
Course Name: Lab course on 24CsCmpU5201 (Android Programming)
Teaching Scheme: PR: 4 Hours/Week **Credit: 02**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Knowledge of programming in Java
- Knowledge of XML
- Understanding of core Android components

Course Objectives:

- Learn how to set up Android Studio and use its features for efficient Android app development.
- Practice using Android Studio's tools like the emulator, and the UI designer.
- Create interactive user interfaces with UI components such as buttons, text fields, images etc. and perform event handling.
- Implement navigation using Activities and Fragments.
- Design and implement mobile applications involving data storage in SQLite database
- Use location-based services, multimedia in developing applications

Course Contents:

Sr.No	List of Practical
1	Android Installation and Introduction to Android Studio
2	Running Simple Hello World
3	Applying different Layouts
4	Activity and Intent
5	User Interface and Event Handling
6	ImageSwitcher
7	Spinner
8	Custom Toast
9	TimePicker, DatePicker,
10	Alert Dialog
11	Menus
12	Multimedia: Play audio, video
13	Location-Based Services and Google Maps
14	Databases – Sqlite

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Shivajinagar, Pune – 5

T.Y. B. Sc. (Computer Science) (NEP 2024)

Course Code:24CsCmpU5203

Course Name: Software Testing (Major Elective)

Teaching Scheme: 2Lectures/Week **Credits: 2**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Desirable Prerequisites:

- Knowledge of Software Engineering

Course Objectives:

- To introduce testing concepts and evolution
- To discuss the levels of testing
- To explain various types of testing
- To discuss the different testing techniques

Course Outcomes

CO No.	Course Outcome	Blooms cognitive Level
CO 1	Define software testing process &listprinciples	1
CO 2	Classify Levels of testing	2
CO 3	Organize different types of Testing	3
CO 4	Analyse appropriate testing techniques	4
CO 5	Determine the role of tester& test manager	5
CO 6	Choose appropriate testing tools	6

Course Contents: **Total Lectures : 30 Hrs**

Unit No.	Title	Lectures
Unit 1	**Fundamentals of Testing**	**4**

	• Definition of software testing
	  ○ Objectives of testing
	  ○ Testing and Debugging
	• Necessity of Software Testing
	  ○ Error, Bug, fault, defect and failure
	• Seven Testing Principles
	• Testing Process (STLC)	

Unit 2	**Software Development Life Cycle**	**2**

	• SDLC Models- Waterfall Model, V Model
	• Agile Testing – Test driven software development
	• Levels of Testing
	  ○ Unit Testing
	  ○ Integration Testing
	  ○ System Testing
	  ○ Acceptance Testing	

Unit 3	**Types of Testing**	**5**

	• Functional Testing (Black box)
	• Non-Functional Testing
	  ○ Performance, Usability testing
	  ○ Portability, security testing
	• Structural (White-Box) Testing
	• Change related testing
	  ○ Re-testing & regression Testing	

Unit 4	**Static Testing and Dynamic Testing**	**4**

	• Static Testing techniques -Review
	  ○ Review Process
	  ○ Roles and Responsibilities in formal review
	  ○ Review Types
	• Static Testing techniques - Static Analysis
	• Difference Between Static and Dynamic Testing	

Unit 5	**TestingTechniques**	**7**

	• Categories of Testing Techniques
	• Black Box Testing Techniques
	  ○ Equivalence Partitioning
	  ○ Boundary Value Analysis
	  ○ Decision Table Testing
	  ○ State Transition Testing	

	○ Use case Testing • White-Box Testing Techniques ○ Statement Testing and coverage ○ Decision Testing and Coverage • Experience based Testing Techniques ○ Error Guessing ○ Exploratory Testing	
Unit 6	**Test Management**	**4**
	• Test Organization ○ Independent Testing ○ Tasks of Test manager and tester • Test Planning and Estimation • Test progress monitoring and control • Configuration management • Risk and Testing ○ Project risk and Product risk • Defect management ○ Defect Life Cycle	
Unit 7	**Introduction to Automation Testing**	**1**
	• Definition of Automation Testing • Benefits of Automation Testing	
Unit 8	**Tools Support for Testing**	**3**
	• Typesof Testtools– CAST(onlytype& their purpose) • Effective use of tool(BenefitsandRisks) • Introductionofatoolintoanorganization (e.g. Selenium, JMeter, Postman, Jira)	

Reference books:

- **Naik, K., & Tripathy, P. (2021).** *Software Testing and Quality Assurance: Theory and Practice (3rd ed.).* Wiley.
- **Graham, D., Black, R., & van Veenendaal, E. (2020).** *Foundations of Software Testing: ISTQB Certification (4th ed.).* Cengage Learning.
- **Crispin, L., & Gregory, J. (2021).** *More Agile Testing: Learning Journeys for the Whole Team.* Addison-Wesley.
- **Clokie, K. (2020).** *A Practical Guide to Testing in DevOps.* Leanpub.
- **Kinsbruner, E. (2020).** *Continuous Testing for DevOps Professionals.* Packt Publishing.
- **Whittaker, J. A., Arbon, J., & Carollo, J. (2021 edition).** *How Google Tests Software.* Addison-Wesley.
- **Molyneaux, I. (2020).** *The Art of Application Performance Testing (2nd ed.).* O'Reilly Media.
- **Fewster, M., & Graham, D. (2021 edition).** *Software Test Automation.* Addison-Wesley.

- **Tse, T. H. (2021).** *Testing Object-Oriented Programs.* Springer.
- **Roman, A. (2021).** *A Study Guide to the ISTQB Foundation Level.* Springer.

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)
Shivajinagar, Pune – 5

T.Y. B. Sc. (Computer Science) (NEP 2024)

Course Code:24CsCmpU5204

Course Name: Lab course on 24CsCmpU5203 (Software Testing)

Teaching Scheme: 2 Lectures/Week **Credits: 2**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Practical Activities / Assignments

Sr. No	Assignment
1.	Writing functional test cases for a web login module
2.	Applying boundary value analysis for form validation
3.	Calculating Cyclomatic complexity of sample programs
4.	Implementing automated tests using Selenium WebDriver
5.	Performing load testing using JMeter
6.	Testing REST APIs using Postman
7.	Recording and managing defects using JIRA

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
Third Year of B.Sc. (Computer Science)
(2024 Course under NEP 2020)

Course Code: 24CsMatU5205
Course Name: Numerical Methods
Teaching Scheme: TH: 2 Hours/Week **Credit: 02**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites: Calculus, Differential equations, Polynomials**,** Errors, Bisection method.

Course Objectives: To Study
- Various methods for solving algebraic and transcendental equations.
- Concept of finite differences and the use of operators like Δ, ∇, δ, and E.
- Relationships among different finite difference operators and their applications.
- Polynomial interpolation.
- Numerical integration.
- Numerical methods to solve ordinary differential equations.

Course Outcomes: On completion of the course, student will be able to:-
- Find a real root of an equation.
- Construct and analyze difference tables and estimate missing values.
- Analyze relationships among finite difference operators and apply them to solve numerical problems.
- Approximate an unknown continuous function by a polynomial, with desired accuracy.
- Perform numerical differentiation using discrete data points.
- Find the value of a definite integral of an explicitly unknown function, given a set of data points.
- Solve first order ordinary differential equations.
- Analyze accuracy, efficiency and limitations of different numerical methods.

Course Contents:

Chapter 1	**Solution of an equation**	**4 hours**
	• False position method. • Iterative method. • Newton-Raphson method.	
Chapter 2	**Calculus of finite differences**	**5 hours**
	• Operators: Δ, ∇, δ, μ, E. • Relation between operators. • Difference table. • Determination of missing term.	

Chapter 3	**Interpolation**	**10 hours**
	● Newton's Gregory formula for forward interpolation. ● Newton's Gregory formula for backward interpolation. ● Bessel's formula. ● Everett's formula. ● Lagrange's interpolation formula. ● Newton's divided difference formula.	
Chapter 4	**Numerical differentiation and integration**	**6 hours**
	● Numerical differentiation ● General quadrature formula. ● Trapezoidal rule. ● Simpson's 1/3 rule. ● Simpson's 3/8 rule.	
Chapter 5	**Numerical solution of ordinary differential equation**	**5 hours**
	● Solution by Taylor's series ● Euler's method. ● Euler's modified method. ● Runge-Kutta methods.	
	Total no. of hours	**30**

Reference Books:

1) A textbook of Computer Based Numerical and Statistical Techniques, by A. K. Jaiswal and Anju Khandelwal, New Age International Publishers, 2009.
2) Computer Oriented Numerical Methods by V. Rajaraman, PHI Learning Private Limited, New Delhi, Third Edition, 2011.
3) Introductory Methods of Numerical Analysis, by S.S. Sastry, Prentice Hall of India Fifth Edition, 2012.
4) Numerical Methods by E Balagurusamy, Tata McGraw Hill Education Private Limited, New Delhi, Reprint 2012.

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
Third Year of B.Sc. (Computer Science)
(2024 Course under NEP 2020)

Course Code: 24CsMatU5206
Course Name: Lab Course on 24CsMatU5205 (Numerical Methods)
Teaching Scheme: PR: 4 Hours/Week **Credit: 02**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites: Calculus, Differential equations, Polynomials**,** Errors, Bisection method, C programming language.

Course Objectives: To Study

- Various methods for solving algebraic and transcendental equations.
- Concept of finite differences and the use of operators like Δ, ∇, δ and E.
- Relationships among different finite difference operators and their applications.
- Polynomial interpolation.
- Numerical integration.
- Numerical methods to solve ordinary differential equations.

Course Outcomes: On completion of the course, student will be able to:-

- Find a real root of an equation.
- Construct and analyze difference tables and estimate missing values.
- Analyze relationships among finite difference operators and apply them to solve numerical problems.
- Approximate an unknown continuous function by a polynomial, with desired accuracy.
- Perform numerical differentiation using discrete data points.
- Find the value of a definite integral of an explicitly unknown function, given a set of data points.
- Solve first order ordinary differential equations.
- Analyze accuracy, efficiency and limitations of different numerical methods.

Course Contents:

	List of Practicals
Practical 1	Series expansion of elementary functions
Practical 2	False position method
Practical 3	Iteration method
Practical 4	Newton's Raphson Method
Practical 5	Newton's forward difference interpolation method
Practical 6	Newton's backward difference interpolation method

Practical 7	Bessel's and Everett's formula
Practical 8	Newton's divided difference method
Practical 9	Lagrange's interpolation method
Practical 10	Numerical differentiation
Practical 11	Trapezoidal rule
Practical 12	Simpson's 1/3 and 3/8 Rule
Practical 13	Solution of ordinary differential equation by Taylor's series
Practical 14	Euler's method and Euler's modified method
Practical 15	Runge-Kutta methods

Reference Books:

1) A textbook of Computer Based Numerical and Statistical Techniques, by A. K. Jaiswal and Anju Khandelwal, New Age International Publishers, 2009.
2) Computer Oriented Numerical Methods by V. Rajaraman, PHI Learning Private Limited, New Delhi, Third Edition, 2011.
3) Introductory Methods of Numerical Analysis, by S.S. Sastry, Prentice Hall of India Fifth Edition, 2012.
4) Numerical Methods by E Balagurusamy, Tata McGraw Hill Education Private Limited, New Delhi, Reprint 2012.

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous College), Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science) Major Elective: Electronics

(NEP 2024) SEMESTER V

Course Code:- 24CsEleU5207

Course Name: Embedded System

Teaching Scheme: TH: 2 hrs / Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites: Basic knowledge of Microcontroller, Digital Electronics, and C Programming.

Course Objectives: This course will enable the students to:

1. To understand the architecture 8-bit microcontroller
2. To understand registers and modules of PIC controller.
3. To understand basics of interfacing concepts.
4. To learn software techniques to embed codes into the systems.
5. To interface different peripherals to PIC controller.
6. To learn communication standards and protocols

Course Outcomes

- Understand the architecture and components of embedded systems.
- Understand the **architecture and operation** of PIC microcontrollers.
- **C programming** for PIC.
- Design and develop embedded system applications using hardware and software tools.
- Interface peripherals such as sensors, actuators, and communication devices with PIC.
- Develop **real-time embedded applications**.
- Gain exposure to **PIC development tools** and simulation software.

Course Content:-

Chapter 1	**Introduction to Embedded Systems & PIC Microcontrollers**	6 hrs
	Definition and characteristics of embedded systems, Applications of embedded systems, Differences between general-purpose and embedded systems, Embedded system design process, Introduction to **PIC microcontrollers,** PIC microcontroller families & selection criteria, Applications of **PIC-based systems.**	
Chapter 2	**PIC Microcontroller Architecture**	10 hrs
	Internal architecture of PIC microcontrollers:- CPU, Memory (Flash, RAM, EEPROM), I/O Ports and Pin configuration, Clock and Reset circuits, Power-saving modes. Interrupt handling & Priorities Timer0, Timer1 modules (Block diagram, control registers, operation modes, prescaler, postscaler), Delay generation C-codes,	

	Interrupt structure: Block diagram, control registers, vector table, priority settings, Interrupt sources: external INTx, Timer overflow, peripheral interrupts, PWM generation (using CCP/ECCP modules), Watchdog timer & low-power modes (Sleep, Idle).	
Chapter 3	**PIC Programming Fundamentals**	6Hrs
	Assembly vs. Embedded C programming Overview of MPLAB X IDE and XC8 Compiler Writing, compiling, and debugging programs, Interfacing LEDs, switches, and buzzers, (PWM generation),Serial Communication (UART, SPI, I2C)	
Chapter 4	**Sensor Interfacing & Data Acquisition**	8Hrs
	ADC module: 10-bit ADC, channel selection, reference voltages, acquisition time, Analog sensor interfacing (temperature – LM35, light – LDR/photoresistor, Digital-to-Analog Conversion (DAC) and Interfacing common peripherals: LCD , Keypad, RTC (DS1307) & EEPROM, IR Sensors, Ultrasonic Sensors, Accelerometer & Gyroscope	

Text/ Reference Books:

1. "PIC Microcontroller and Embedded Systems" – Muhammad Ali Mazidi,Pearson publisher,2nd edition.
2. "Programming PIC Microcontrollers in C" – Lucio Di Jasio, Elsevier, 3rd edition.
3. "Embedded C Programming & the Microchip PIC" – Richard H. Barnett, Elsevier Science, 1st edition.
4. Microchip Official Website & Documentation
5. MPLAB X IDE & XC8 Compiler User Guides, A press publisher, 1st edition.

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous College), Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science) Major Elective: Electronics

(NEP 2024) SEMESTER V

Course Code:- 24CsEleU5208

Course Name: Lab course on 24CsEleU5207 (Embedded System)

Teaching Scheme: PR: 4 hrs / Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Course Outcomes:

- Understand the architecture and components of embedded systems.
- Understand the architecture and operation of PIC microcontrollers.
- Develop basic C programming for PIC microcontroller.
- Design and develop embedded system applications using hardware and software tools.
- Understand to Interface peripherals such as sensors, actuators, and communication devices with PIC.
- Develop soft real-time embedded applications.
- Gain exposure to PIC development tools and simulation software.

List of Practical

1. Getting Started with MPLAB X IDE & XC8 Compiler.
2. Arithmetic operations of PIC using MPLAB X software.
3. Basic I/O operations of PIC with Switch Interfacing: Single key interface result on LED.
4. Study of LED bank interfacing and programming to PIC microcontroller.
5. To study for Generating Delays using Timers and SSD Interfacing to PIC microcontroller.
6. Study of waveform generations using DAC and PIC.
7. Study for PWM Generation for speed control of DC motor using PIC.
8. Study of External interrupt as input switch press, output at relay.
9. Study to interface ADC for reading of sensor values using PIC.
10. Programming for UART Communication of PIC with PC.
11. To study the I2C Interfacing with external EEPROM.
12. To study programming for LCD Interface (16x2 & Graphical LCD).
13. Study to interface Stepper Motor to PIC.
14. Study Wireless communication using Bluetooth module and PIC.
15. 4X4 keyboard interface to PIC microcontroller system.
16. Traffic light controller.
17. Interfacing of gas sensors for Fire alarm system.
18. RTC module interface to PIC microcontroller.
19. Automatic irrigation system.
20. Study of communication protocols between multiple PIC microntroller.

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science)(NEP 2024)

Course Code: 24CsCmpU5501

Course Name: Lab Course on Web Technology (VSC)

Teaching Scheme: PR: 4 Hours/Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem : 30 Marks**

Prerequisite Courses:

- **Familiarity with web technologies (HTML, CSS, HTTP)**

Course Objectives:

- **Build a strong foundation in NodeJS server-side programming, architecture**
- **Tell learners on Express JS framework**
- **Utilize the Express framework to design and implement robust web applications.**
- **Introduce middleware, routing and environment variables in Express.**
- **Integrate NodeJS, Express for end-to-end applications.**
- **Apply CRUD operations with MySQL.**
- **Prepare students for real-time backend projects using NodeJS**

Course Outcomes:

- **Understanding NodeJS architecture and module system.**
- **Understand Node.js middleware, routing in Express**
- **Node.js session and cookies.**
- **Node.js connection with MySQL.**
- **Gain practical, hands-on experience by building and deploying real-world, full-stack applications.**

Course Contents:

Sr.No	List of practical
1	**Familiarity with web technologies (HTML, CSS, JavaScript)** **Simple JavaScript programs using functions, design forms and Event Handling**
2	**Study Express JS framework. Develop your first Application**
3	**Node.js form handling using GET and POST method using static files.**

4	**Node.js middleware programming**
5	**Node.js using template engines**
6	**Node.js using routing in Express**
7	**Node.js MVC architecture**
8	**Node.js Connecting Databases MySQL**
9	**Authentication and Session Handling**
10	**Apply CRUD operations with MySQL**
11	**Prepare for real-time backend projects using Node.js**

Reference Books:

1. Node.js The Comprehensive Guide Author Sebastian Springer

ISBN 978-1-49322292-6

2. Web Development with Node & Express Author Ethan Brown

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
Third Year of B.Sc. (Computer Science)
(2024 Course under NEP 2020)

Course Code: 24CsMatU5301
Course Name: Lab Course on Operations Research
Teaching Scheme: PR: 4 Hours/Week **Credit: 2**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: System of linear equations, linear inequalities, Matrices, Graph plotting

Course Objective: To Study
- Linear Programming Problems.
- Assignment Models.
- Transportation Models.
- Game Theory

Course Outcomes: On completion of the course, student will be able to
- Formulate real-life optimization problems as Linear Programming Problems (LPP).
- Solve Linear Programming Problems using graphical and simplex methods.
- Interpret optimal solutions of LPP in terms of practical decision-making.
- Construct and solve Transportation Problems using appropriate methods (North-West Corner, Least Cost, VAM).
- Optimize transportation models and test for optimality using MODI method.
- Formulate and solve Assignment Problems using the Hungarian Method.
- Analyze two-person zero-sum games and determine optimal strategies using graphical and algebraic methods.
- Apply Operations Research techniques to support managerial and industrial decision-making.

Course Contents:

Practical 1: Formulation of Linear Programming Problems from Real-Life Situations
Practical 2: Solution of LPP using Simplex Method
Practical 3: Solving LPP using Big-M Method
Practical 4: Identification of Multiple, Unbounded and Infeasible Solutions in LPP
Practical 5: Initial Basic Feasible Solution using North-West Corner Method
Practical 6: Initial Basic Feasible Solution using Least Cost Method
Practical 7: Initial Basic Feasible Solution using Vogel's Approximation Method
Practical 8: Optimality Test using MODI Method
Practical 9: Solving Assignment Problem using Hungarian Method
Practical 10: Assignment Problem with Maximization Case
Practical 11: Solution of 2×2 Games using Algebraic Method
Practical 12: Solution of 2×n and m×2 Games using Graphical Method
Practical 13: Solution of Games using Dominance Principle
Practical 14: Case Study-I (for e.g. Airline Crew Scheduling)
Practical 15: Case Study-II (for e.g. Inventory Management)

Reference Books:

1) Operation Research (12th Edition), by S. D. Sharma.
2) Operations Research: An Introduction, by Hamdy A. Taha, Pearson (9th Edition), 2014.
3) Operation Research: Theory and Applications, by J. K. Sharma, 4th Edition, 2017.

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous College), Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science) Minor: Electronics

(NEP 2024) SEMESTER V

Course Code:- 24CsEleU5302

Course Name: Lab course on RPI based IOT

Teaching Scheme: PR: 4 hrs / Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites: Basic knowledge of Microcontroller, Digital Electronics, and C Programming.

Course Objective:

- To study concept of wireless communication.
- To learn the concepts of cellular telephony.
- To learn the IoT basics and its architecture.
- To learn the application areas of IoT.

Course Outcomes:

After completing this course, students will be able to:

- ✓ CO1: Understand the Raspberry Pi and it interfacing.
- ✓ CO2: Understand the basics of different wireless technologies used in IoT implementation.
- ✓ CO3: Interface the different sensors with Raspberry Pi.
- ✓ CO4: Understand the programming language – Python.
- ✓ CO5: Write and execute the different programmes using Python for IoT applications.

Course Content:-

I) Any 12 experiments from following

1. Study of Zigbee communication
2. Study of RFID communication.
3. Environmental monitoring using LoRa sensors
4. Find number of digits in the number using Python.
5. Calculation of mean, variance , standard deviation of given data
6. Plot graph for given observation table using Python/GNU plot.
7. LED switching using mobile
8. Study of actuators (relay, motor, buzzer) in IoT systems
9. Displaying data on LCD received via Bluetooth
10. Stepper motor control using Bluetooth
11. LED switching using mobile web server
12. Ultrasonic sensor data sending to cloud using HTTP POST
13. LDR interfacing with ThingSpeak cloud
14. sending DHT11 sensor data using REST API to ThingSpeak cloud
15. IoT-based smoke detection system with alert
16. PIR sensor interfacing with ThingSpeak cloud

17. IoT-based weather station (DHT11 + cloud visualization)(BlynkIoT)
18. Implementing MQTT protocol using Python (paho-mqtt)
19. Developing IoT web application using Django framework

II) Mini project/ Field visit to electronic industry carries equivalent to 3 experiments

SEM VI

1. **24CsCmpU6101 Operating System Concepts**
2. **24CsCmpU6102 Programming in Advanced Java**
3. **24CsCmpU6103 Computer Networks**
4. **24CsCmpU6104 Foundation of Data Science**
5. **Lab course on 24CsCmpU6101**
6. **Lab course on 24CsCmpU6102**
   Major Elective

---

7. **24CsCmpU6201 Big Data Analytics**
8. **24CsCmpU6202 Lab course on 24CsCmpU6201**
   Or
9. **24CsCmpU6203 C# DOT NET**
10. **24CsCmpU6204 Lab course on 24CsCmpU6203**
    Or
11. **24CsMatU6205 Computational Geometry**
12. **24CsMatU6206 Lab course on 24CsMatU6205**
    Or
13. **24CsEleU6207 Wireless Sensor network and IoT**
14. **24CsEleU6208 Lab course on 24CsEleU6207**

---

15. **24CsCmpU6501 Python Programming**

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune – 5

T.Y. B. Sc. (Computer Science)
(NEP 2024)

Course Code: 24CsCmp6101
Course Name: Operating System concepts

Teaching Scheme: TH: 2 Hours/Week **Credit: 2**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

Students should have basic knowledge of Computer Science and Computer Organization

Course Objectives:

- To Study the basic concepts and functions of operating systems.
- To Understand the structure and functions of OS.
- To Learn about Processes and Scheduling algorithms.
- To Understand the principles of concurrency and Deadlocks.
- To Learn various memory management schemes.
- To understand File systems allocation methods.

Course Outcomes:

On completion of the course, Students will be able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Outline the role of OS in Computer system	1
CO 2	Explain the concept of process synchronization	4
CO 3	Implement different CPU scheduling and memory management strategies	3

CO 4	Understand system services and its examples, system calls and its types.	2
CO 5	Identify and evaluate the storage management policies with respect to different file /storage management methods.	5
CO 6	Simulate different deadlock management strategies using deadlock prevention, avoidance and detection techniques.	6

Course Contents

Unit No.	Title	Lectures
Unit 1	**Introduction to Operating Systems**	**3**
	1.1. Defining Operating System 1.2. Operating System Services 1.3. Types of Operating Systems 1.4. User Operating -System Interface –Command interpreter, GUI 1.5. System Calls(Only concept) 1.6. Operating System Structure (refer the book The Design of the UNIX Operating System by Maurice J. Bach)	
Unit 2	**Process Concept**	**5**
	2.1. Introduction to Processes 2.2. Process State, PCB 2.3. Process scheduling 2.4. Operations on processes 2.5. Process Synchronization	
Unit 3	**CPU Scheduling**	**6**
	3.1. Basic Concept - CPU-I/O burst cycle, CPU scheduler, Preemptive and Non preemptive scheduling, Dispatcher 3.2. Scheduling Criteria 3.3. Scheduling Algorithms - FCFS, SJF, Priority scheduling, Round-robin scheduling (Only Problems) 3.4. Multilevel queue and Multilevel Feedback	

	queue scheduling(only concepts)	
Unit 4	**Deadlock Management**	**7**
	4.1. Deadlocks 4.2. System model 4.3. Deadlock Characterization - Necessary conditions, Resource allocation graph 4.4. Deadlock Prevention 4.5. Deadlock Avoidance - Safe state, Resource allocation graph algorithm, Banker's Algorithm (Only Problems) 4.6. Deadlock Detection (Only Concepts) 4.7. Recovery from Deadlock - Process termination, Resource pre-emption (Only Concepts)	
Unit 5	**Memory Management**	**7**
	5.1. Address binding 5.2. Logical versus physical address space, Dynamic loading, Dynamic linking and shared libraries 5.3. Swapping 5.4. Contiguous Memory Allocation (Only Concepts) 5.5. Fragmentation 5.6. Paging - Basic method, Hardware support, Protection, Shared Pages 5.7. Segmentation - Basic concept 5.8. Virtual Memory Management - Demand paging, Page replacement - FIFO, OPT, LRU	
Unit 6	**File System**	**2**
	6.1 File Concept 6.2 Allocation Methods- Contiguous allocation, Linked allocation, Index Allocation(Only Concepts)	

Reference books:

- Operating System Concepts by Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 10th Edition, John Wiley and Sons, **ISBN-10 :** 1119800366, **ISBN-13 :** 978-1119800361
- Operating System Concepts by James L. Peterson, Abraham Silberschatz,Addison-Wesley,3rd Edition, ISBN-13: 978-0201513790 ISBN-10: 020151379X
- Modern Operating Systems by Andrew S. Tanenbaum, 4th Edition, Addison Wesley, ISBN-13: 978-0133591620 ISBN-10: 013359162X
- The Operating Systems: A Concept-Based Approach by D M Dhamdhere, 3rd Edition, Tata Mc Graw-Hill Education, ISBN-10: 1259005585 ISBN-13: 978-1259005589
- The Operating Systems – Internals and Design Principles by William Stallings, 7th Edition, Prentice Hall, ISBN-13: 978-0133805918 ISBN-10: 0133805913

Progressive Education Society's

Modern College of Arts, Science and Commerce(Autonomous),
Shivajinagar, Pune - 5

Third Year of B.Sc. (Computer Science)
(NEP 2023)

Course Code : 24CsCmpU6102
Course Name : Programming in Advanced JAVA

Teaching Scheme: 2 Hours/Week **Credits: 2**
Examination Scheme: CIA : 20 Marks **End-Sem: 30 Marks**

Desirable Prerequisites: Knowledge of Core Java

Course Objectives:

- To learn database programming using Java
- To study web development concept using Servlet and JSP
- To learn socket programming for developing Client-Server applications

Course Outcomes:
On completion of the course, Students will be able to:

CO No	Course Outcomes(COs)	Blooms Cognitive level
1	Recall and define advanced Java concepts such as multithreading, networking, Java database connectivity (JDBC)	1
2	Illustrate the use of multithreading, concurrency, and synchronization mechanisms in Java applications.	2
3	Apply JDBC to connect to a database and perform CRUD operations (Create, Read, Update, Delete).	3
4	Break down software requirements and determine how to implement solutions using design patterns, advanced Java features, and frameworks.	4
5	Evaluate database design decisions and recommend improvements in the context of performance, maintainability, and scalability.	5
6	Design and implement advanced Java applications that integrate multiple technologies (e.g., multi-threading, database, networking, and GUI).	6

Course Contents

Unit No.	Title	Lectures
Unit 1	**Collections**	**6**
	1.1 Introduction to the Collection Framework 1.1.1 Overview of Collections in Java 1.1.2 Benefits of Using Collections 1.1.3 Collection Framework Hierarchy **1.2** List Interface 1.2.1 ArrayList 1.2.2 LinkedList 1.2.3 Vector 1.2.4 Stack 1.2.5 Queue **1.3** Set Interface 1.3.1 HashSet 1.3.2 TreeSet 1.3.3 LinkedHashSet **1.4** Important Interfaces in Collections 1.4.1 Comparator Interface 1.4.2 Iterator Interface 1.4.3 ListIterator Interface 1.4.4 Enumeration Interface	
Unit 2	**Database Programming**	**6**
	2.1 Introduction to JDBC and Architecture 2.1.1 What is JDBC? 2.1.2 Features of JDBC 2.1.3 JDBC Architecture and Components 2.1.4 Types of JDBC Drivers **2.2** Processing SQL Statements with JDBC 2.2.1 Establishing a Connection 2.2.2 Executing SQL Queries (Statement, PreparedStatement, CallableStatement) 2.2.3 Handling ResultSet and Retrieving Data 2.2.4 Updating and Deleting Records Using JDBC	
Unit 3	**Servlet**	**6**
	3.1 Introduction to Servlet 3.2 Servlet life cycle 3.3 Handing of Request and Response 3.4 Session tracking 3.4.1 User Authorization 3.4.2 URL Rewriting 3.4.3 Hidden form fields 3.4.4 Cookies	
Unit 4	**Java Server Pages**	**6**
	4.1 Introduction to JSP 4.1.1 What is JSP? 4.1.2 Features and Advantages of JSP 4.1.3 Difference Between JSP and Servlets JSP Lifecycle	

	4.1.4 Implicit Objects 4.2 Scripting Elements 4.2.1 Declarations (<%! %>) 4.2.2 Expressions (<%= %>) 4.2.3 Scriptlets (<% %>) 4.2.4 Comments (<%-- --%>) 4.3 JSP Directives 4.3.1 Page Directive (<%@ page %>) 4.3.2 Include Directive (<%@ include %>) 4.4 Simple JSP Program	
Unit 5	**Multithreading**	**3**
	5.1 What are threads? 5.2 Thread Lifecycle 5.3 Usage of Thread class / Runnable Interface 5.4 Thread Priorities	
Unit 6	**Introduction to Frameworks**	**3**
	6.1 Spring Framework 6.1.1 Introduction to Spring Framework and Beans 6.1.2 Understanding Dependency Injection 6.1.3 Spring Applications and Configuration 6.1.4 Overview of Spring MVC Framework 6.2 Introduction to Components of Hibernate 6.2.1 What is Hibernate? 6.2.2 Hibernate Architecture and Components 6.2.3 Hibernate ORM and Persistence 6.3 Introduction to Struts Framework 6.3.1 Overview of Struts Framework 6.3.2 Features and Advantages of Struts 6.3.3 Struts MVC Architecture 6.4 Introduction to Maven Framework 6.4.1 What is Maven? 6.4.2 Maven Project Structure and Build Lifecycle 6.4.3 Understanding MOJO (Maven Plain Old Java Object) 6.4.4 Understanding POJO (Plain Old Java Object)	

References Books:

1. Java The Complete Reference - Eleventh Edition, Herbert Schildt, Tata Mc Graw Hill, ISBN-13 : 978-9390491629
2. Programming with Java 6th Edition, E Balagurusamy, ISBN-13 : 978-9353162344
3. Core Java, Volume II—Advanced Features, Tenth Edition, Pearson publication, ISBN-13 : 978-0134177298
4. Getting started with Spring Framework: covers Spring 5 by J Sharma and Ashish Sarin, ISBN-13 : 978-1979962780
5. Spring 4 for Developing Enterprise Applications: An End-to-End Approach by Henry H.Liu, ISBN-13 : 978-0615639451

Reference link: https://docs.oracle.com/javase/8/

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science) Sem- VI
(2024 Course under NEP 2020)

Course Code:24CsCmpU6103
Course Name: Computer Networks

Teaching Scheme: TH: 2 Hours/ Week **Credit: 02**

Examination Scheme: CIA:20 Marks **End-Sem:30 Marks**

Prerequisite Courses:

- To understand basic knowledge of Communication principals
- Knowledge of basic digital electronics

Course Objectives:

- Understand different types of networks, various topologies and application of networks..
- Understand the concept of networking models, protocols, functionality of each layer.
- To get the knowledge of upper layers for network model.
- To understand the concept of network security, security services and security techniques.

Course Outcomes: After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	**Define** basic concepts of data communication and computer networking.	1
CO 2	**Explain** networking models and addressing schemes.	2
CO 3	**Identify** the different types of network topologies, network type and protocols.	3
CO 4	**Functions** of each layers of OSI and TCP/IP model.	4
CO 5	**Explain** the working of physical Layer, data link layer, Network layer, Transport Layer, Application Layer	5
CO6	**Design** of Network using respective layer protocols. Discuss various Network security techniques used in real world applications.	6

Course Contents:

Unit 1	Introduction to Networks and Network Models	Lectures (Hrs)
	1.1 Computer Networks – Goals, Applications, Design Issues Topologies. 1.2 Transmission Technologies – Broadcast and Point-to-Point 1.3 Types of Networks – LAN, MAN, WAN, Internet 1.4 Data Communication- Serial (Synchronous, Asynchronous, Isochronous) and Parallel transmission 1.5 Circuit Switching, Packet Switching an Message Switching 1.6 OSI Reference Model Vs TCP/IP	6
Unit 2	**Multiple Access Control Layers**	**Lectures**
	2.1 Persistent (1 and P), Non-persistent , CSMA, CSMA/CD, CSMA/CA 2.2 Traditional Ethernet (IEEE 802.3), Fast and Gigabit Ethernet 2.2 Wireless LAN: IEEE 802.11, Bluetooth 2.3 Virtual LAN	5
Unit 3	**Network Layer**	**Lectures**
	3.1 Network layer services - Virtual Circuit Vs Datagram, Routing Algorithm – Adaptive vs non-adaptive, desirable properties of routing algorithm 3.2 Congestion Control and prevention strategies 3.2 IPv4 addressing Datagram - Classful Addressing , subnetting, supernetting, Network Address Translation (NAT), Classless Addressing, Fragmentation 3.3 Address Resolution Protocols - ARP, RARP 3.4 Dynamic Host Configuration Protocol (DHCP)	6
Unit 4	**Transport Layer**	**Lectures**
	4.1 Transmission Control Protocol (TCP) – Segment Format, Thre Way Handshaking to Establish Connection, Connection Termination (3 and 4 way handshaking) 4.2 Transport Layer Mobility – Indirect-TCP, TCP Snooping and Mobile TCP 4.3 User Datagram Prottocol (UDP) – Datagram Format and Operations 4.4. Transport Layer Security – Secure Socket Layer (SSL)	4
Unit 5	**Application Layer**	**Lectures**
	5.1 Domain Name System (DNS) Name Space, Domain, Name Space, Distribution of Name Space, DNS in the Internet, Resolution 5.2 E-MAIL Architecture, User Agent, Message Transfer Agent-SMTP, Message Access Agent-POP3, IMAP4, Web Based Mail 5.3 File Transfer Protocol (FTP) Communication over control connection, Communication over Data Connection, Anonymous FTP	5

	5.5 HTTP - HTTP Transaction, Persistent and Non persistent Connection, Proxy Server 5.6 HTTPS – Secure HTTP Connection	
Unit 6	**Internetworking Devices**	**Lectures**
	6.1 Gateways – Unidirectional and bidirectional, network gateway, cloud storage gateway, IoT gateway, Email security gateway, VoIP trunk gateway, Email security gateway, API gateway, Internet – to –orbit (I2O) gateway, payment gateway 6.2 Routers – Wifi router, Wired router, virtual router, mobile routers 6.3 Bridges – Source Routing and Transparent bridges	4

For some algorithm conduct group activity as assessment

Reference Books:

1. Computer Networks by Andrew Tanenbaum, Pearson Education.[5th Edition], Pearson Education
   India, ISBN-10 9356063605ISBN-13 978-9356063600.
2. Data Communication and Networking by Behrouz Forouzan, TATA McGraw Hill, [4th Edition]
   ISBN- 9780072967753, 0072967757.
3. Data and Computer Communication By William Stallings [10th Edition], Pearson Education
   India, ISBN-10 0133506487, ISBN-13 978-0133506488.
4. Networking All In One Dummies, Wiley Publication.[8th Edition] ISBN: 978-1-119-68901-0,

E-Books

1. https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Computer%20Networks.pdf
2. https://elcom-hu.com/Subjects/Computer/Compulsory/Communication/Data-Communications-and-Network-5e.pdf
3. https://nibmehub.com/opacservice/pdf/read/Data%20and%20computer%20communications%20by%20Stallings-%20William-compressed.pdf.
4. https://nibmehub.com/opac-service/pdf/read/Data%20and%20computer%20communications%20by%20Stallings-%20William-compressed.pdf

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune – 5

T.Y. B. Sc (Computer Science)
(2024 Course under NEP)

Course Code: 24CsCmpU6104
Course Name: Foundation of Data Science

Teaching Scheme: TH: 2 Hours/ Week **Credit: 02**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Basic knowledge of mathematics, statistics, Python and R package

Course Objectives:

- Introduce students to the fundamental concepts and techniques used in Data Science
- Develop an understanding of data pre-processing, analysis, and visualization techniques
- Introduce students to machine learning
- Equip students with the ability to handle real-world data and derive knowledge and insights

Course Outcomes:
After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Understand the fundamental concepts of Data Science	1
CO 2	Analyze and describe data types, data collection methods, and data cleaning techniques	2
CO 3	Apply data preprocessing techniques and data visualization using graphical techniques.	3
CO 4	Implement Exploratory data analysis methods for the data.	4
CO 5	Evaluate the uncover patterns by applying various machine learning algorithms.	5
CO 6	Elaborate Social Network Analysis using Graphs	6

Course Contents:

Unit 1	**Introduction to Data Science**	**03 lectures**
	1.1 Definition and importance of Data Science 1.2 Role of a Data Scientist, Data Analyst, Data Engineer, Data Architect 1.3 Data science process life cycle 1.4 Overview of tools and technologies (Python, R, Power BI, Weka)	
Unit 2	**Data Collection and Data Types**	**04 lectures**
	2.1 Types of Data: Quantitative vs. Qualitative 2.2 Data Collection Methods: Structured, Unstructured and semi-structured Data 2.3 Data Sources: APIs, Web Scraping, Databases, CSV 2.4 Data Formats and Storage	
Unit 3	**Data Preprocessing and Visualization using Python**	**08 Lectures**
	3.1 Identifying and handling missing data. 3.2 Data Transformation: Normalization, Scaling, Encoding 3.2 Outlier Detection Methods 3.3 Outlier Treatment techniques 3.3 Importance of Data Visualization in Data Science 3.4 Tools and Libraries: Pandas, Matplotlib, Seaborn, Plotly (for Python) 3.5 Basic Visualizations: Histograms, Bar Charts, Line Graphs, Pie Charts 3.6 Advanced Visualizations: Heatmaps, Scatter Plots, Box Plots	
Unit 4	**Exploratory Data Analysis (EDA)**	**05 Lectures**
	4.1 Mean, Variance, Standard deviation, covariance, Pearson's and Spearman's Rank Correlation 4.2 Distance Matrix, measuring symmetric and detection of outliers. 4.3 Concept of random variable, Binomial Distribution, Normal Distribution, Poisson Distribution.	
Unit 5	**Machine Learning Algorithms using Python**	**06 lectures**
	4.1 Supervised Learning: Regression(Simple, Multiple) Decision tree, Support Vector Machine. 4.2 Unsupervised Learning: K-mean 4.3 Ensembled Learning: Random forest	
Unit 6	**Social Network Analysis**	**04 lectures**
	6.1 Defination of SNA, Importance of SNA 6.2 Fundamentals of SNA(Node & edges) 6.3 Definition of Graph, Tie 6.4 Graph view in SNA (directed and undirected graphs, ties) 6.3Networks types (Open, close, Ego & Whole) and network properties	

	6.4 Network analysis methods and techniques (Degree centrality, betweenness centrality and closeness centrality) 6.5 Key python libraries for SNA 6.6. Applications of SNA	
Unit 7	**Experiential Learning**	
	Case studies using python	

Reference Books:

1. **Data Science for Business** by Foster Provost and Tom Fawcett **ISBN**: 9781449361327
2. **Python for Data Analysis** by Wes McKinney **ISBN**-13: 978-1491957660
3. **Introduction to Machine Learning with Python** by Andreas C. Müller and Sarah Guido **ISBN**: 9789352134571
4. **Practical Statistics for Data Scientists** by Peter Bruce and Andrew Bruce **ISBN**: 9781491952962
5. **Online Resources:** DataCamp, Coursera, and edX for hands-on tutorials and courses
6. **Data Science: A Beginners Guide(2023)** by C. Raju

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science)

(NEP 2024)

Course Code: 24CsCmp6105

Course Name: Lab course on **24CsCmp6101: Operating System**

Teaching Scheme: PR: 4 Hours/Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Course Objectives: Design and implement simulations of operating system level procedures.

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Outline the role of OS in Computer science	1
CO 2	Examine the efficiency of scheduling algorithms with use of various scheduling criteria.	4
CO 3	Implement different memory management and deadlock handling strategies .	3
CO 4	Develop the code for algorithms implementing various services provided by Operating System.	6
CO 5	Identify and evaluate the storage management policies with respect to different storage management methods	5
CO 6	Classify preemptive and non preemptive behavior of CPU scheduling algorithms by developing programs and evaluating scheduling criteria like turnaround time and waiting time	2

Sr.No	Assignment	Contents
1	Non-Preemptive CPU Scheduling	FCFS
		SJF
		Priority
2	Preemptive CPU Scheduling	SJF
		Priority
		Round Robin
3	Deadlock Avoidance	Bankers Algorithms
		Resource request algorithm
4	Page Replacement	FIFO
		Optimal
		LRU
5	File Allocation Methods	Contiguous
		Linked
		Indexed

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous)
Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science)
(NEP 2024)

Course Code : 24CsCmpU6106
Course Name : Lab Course on 24CsCmpU6102: Programming in Advanced JAVA

Teaching Scheme: 2 Hours/Week in the Lab **Credits: 2**
Examination Scheme: CIA : 20 Marks **End-Sem: 30 Marks**

Lab work: Programming in Advanced JAVA

Teaching Scheme: 2 Hours/Week in the Lab

Course Objective :

- To learn database programming using Java
- To study web development concept using Servlet and JSP
- Understand the fundamental concepts and functionality of simulators in computing systems.
- Understand the role of an assembler in translating assembly language to machine language
- Develop skills in creating DFA drivers that simulate the execution of DFA models for practical language recognition tasks

Sr. No.	Assignment Name
1.	Collections
2.	Java Database Connectivity
3.	Servlets
4.	Java Server Pages
5.	Multithreading

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune – 5

T.Y. B. Sc. (Computer Science) (NEP 2024)

Course Code: 24CsCmpU6201

Course Name: Elective 2: Big Data Analytics

Teaching Scheme: TH: 2 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Basic Programming (in Python, C, or Java)
- Database Management and SQL

Course Objectives:

- Explain the need and characteristics of Big Data.
- Understand Big Data architectures and ecosystems.
- Describe distributed storage and processing frameworks.
- Apply basic analytical concepts to large datasets.
- Identify real-world use cases of Big Data Analytics.

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Objectives (COs)	Blooms Cognitive level
CO 1	Introduce students to the fundamental concepts, characteristics, and significance of Big Data in modern industries.	1
CO 2	Learn different about NoSQL databases tools, their architectures, and techniques for Big Data Analytics.	2
CO 3	Identify Hadoop and new big data architectures. Provide hands-on experience in executing HDFS commands and managing distributed file systems for data storage processing frameworks like Hadoop.	3

CO 4	Perform / examine different distributed computing paradigms, big data tools and their applications in large-scale data processing for basic data analysis	4
CO 5	Apply & develop students' ability to evaluate and optimize MapReduce& Pig scripts ,Tools for large-scale data processing on Big Data.	5
CO 6	Create and implement interactive dashboards and custom visualization techniques for Big Data analytics.	6

Course Contents:

Unit 1	**Introduction**	**4 Lectures**
	1.1 Introduction to Big Data 1.2 Big data characteristics 1.3 Types of Big Data 1.4 Traditional Vs. Big data approach 1.5 Big Data Challenges 1.6 Infrastructure for Big Data 1.7 Uses Cases of Big Data Analytics 1.8 Applications of Big Data	
Unit 2	**Hadoop Ecosystem and NoSQL Databases**	**4 Lectures**
	2.1 History and Evolution of Hadoop 2.2 Introduction to Hadoop Ecosystem 2.3 Hadoop Vs. Traditional Databases 2.4 NoSQL Databases 2.5 Types of NoSQL Databases 2.6 Comparison of SQL vs. NoSQL	
Unit 3	**Hadoop Framework& HDFS**	**6 Lectures**
	3.1 Components of Hadoop Framework 3.2 Hadoop Distributed File System (HDFS) 3.3 HDFS Architecture 3.4 HDFS Read and Write Operations 3.5 Data Replication and Fault Tolerance 3.4 Hadoop – Commands	
Unit 4	**MapReduce Programming**	**4 Lectures**
	4.1 Introduction to MapReduce 4.2 MapReduce Architecture (Mapper, Reducer, Shuffle and Sort) 4.3 MapReduce Execution Flow 4.4 MapReduce types - input formats, output format 4.5 Writing and Running a Word Count Program in MapReduce (Java / Python)	
Unit 5	**New Architectures of Big Data**	**2 Lectures**
	5.1 Lambda Architecture 5.2 Kappa Architecture	

	5.3 Data Lake Architecture	
Unit 6	**Data Analytics Techniques for Big Data**	**5 Lectures**
	6.1 Data Preprocessing and Data Cleaning 6.2 Exploratory Data Analysis 6.3 Data Mining Techniques and Tools for Big Data 6.4 Use of Machine Learning for Analyzing Big Data 6.5 Predictive Analytics 6.6 Real-Time Analytics	
Unit 7	**Big Data Tools and Applications**	**5 Lectures**
	7.1 Data Ingestion Tools (Apache Flume, Kafka, Sqoop) 7.2 Introduction to Apache Hive 7.3 Pig for Data Processing 7.4 Big Data Visualization Tools (Tableau, Power BI) 7.5 Cloud Platforms for Big Data (AWS, Google Cloud, Azure) 7.6 Big Data Security and Privacy	

Reference Books:

1.Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data
Visualization,DT Editorial Services,ISBN: 9789351199311

2. Hadoop – The Definitive Guide 4e: Storage and Analysis at Internet Scale, Tom White, O′Reilly,
ISBN-13 : 978-1491901632

3. Hands-On Exploratory Data Analysis with Python: Perform EDA techniques to understand, c
summarize, and investigate your data, Suresh Kumar Mukhiya, Usman Ahmed, Packt Publishing
Limited, ISBN-13 : 978-1789537253

4. Big Data and Analytics, 2edSubhashini Chellappan Seema Acharya, Wiley,
ISBN-13 : 978-8126579518

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune – 5

T.Y. B. Sc. (Computer Science) (NEP 2024)

Course Code: 24CsCmpU6202

Course Name: Elective 2: Lab Course on 24CsCmpU6201: Big Data Analytics

Teaching Scheme: PR: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Java Programming Skills (optional Python)
- Fundamentals Database Knowledge
- Basic descriptive statistics

Course Objectives:

- Provide hands-on experience and practical skills in working with Big Data technologies
- To introduce students to the fundamental concepts, and approaches of data visualization tools. (Power BI & Tableau)

Course Contents:

Sr.No	List of Practical
1	Install and Configure Hadoop, Hive, Pig
2	Creating and Managing Files in HDFS
3	Word Count using MapReduce
4	Data Processing and Analysis using Apache Hive, Create Hive tables, Load data into Hive, Perform SQL-like queries on big data
5	Data Processing and Analysis using Apache Pig, Loading datasets, Schema definition, Data filtering and transformation, Aggregation and grouping, Storing processed data in HDFS
6	Installation of Power BI/Tableau and Data Preprocessing for Exploratory Data Analysis: Data Preprocessing and Exploration for Big Data, Data cleaning, Handling missing values, Basic exploratory data analysis

7	Data Visualization using Business Intelligence Tools (Power BI and Tableau assignments) Connecting BI tools to datasets, Extracting and transforming data, creating tables and charts, Formatting visualizations
8	Advanced Data Visualization and Dashboard Creation, Creating interactive dashboards, Multiple chart visualizations, Data interpretation

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune – 5

T.Y. B. Sc. (Computer Science) (NEP 2024) Sem VI

Course Code: 24CsCmpU6203
Course Name: C# DOTNET

Teaching Scheme: TH: 2 Hours/Week **Credit: 2**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Knowledge of object-oriented programming concepts such as data abstraction, encapsulation, inheritance, and polymorphism.
- Familiarity with programming language such as C++ and/or Java.

Course Objectives:

- To understand the DOTNET framework
- Develop deep understanding of C# language features
- Build strong concepts of OOP's and implement the same in C#.
- To understand the concept of event handling.
- To understand and implement the controls & properties of Windows forms.
- To develop database centric applications using ADO.NET.

Course Outcomes:

After successful completion of this course students will be able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Understand the features of Dot Net Framework along with the features of C#.	1
CO 2	Interpret and Develop Interfaces for real-time applications.	2
CO 3	Design & implement Object Oriented Programming concepts like Inheritance and Polymorphism in C# programming language.	3
CO 4	Design & implement the application using event handling.	4
CO 5	Design and Implement Windows Application using Windows Forms & tools application using Database in C#.	5
CO 6	Design and Implement Custom Application Using Windows Form & ADO.NET in C#.	6

Course Contents:

Unit 1	**Introduction to .Net Framework**	**2**
	1.1 Overview of .NET framework &.Net Architecture 1.2 The Common Language Runtime (CLR) 1.3 Microsoft Intermediate Language (MSIL) Code 1.4 Just In Time Compilers (JITers) 1.5 The Framework Class Library (FCL) 1.6 The Common Languages Specification (CLS) 1.7 The Common Type System (CTS) 1.8 Garbage Collection (GC) 1.9 Introduction to Microsoft Visual Studio	
Unit 2	**Basics of C#**	**6**
	2.1 Introduction to C# 2.2 Structure of a C# program 2.3 Basics of C# Language (Console Application) 2.3.1 Data types 2.3.2 Variables and constants 2.3.3 Operators 2.3.4 Input and output statements 2.3.5 Namespace 2.3.6 Variables and Expressions 2.3.7 Type Conversion 2.4 Control statements: • if / else, switch, loops (for, while, do-while) 2.5 Functions, Delegates 2.6 Debugging and error handling 2.7 Exception handling (System Defined and User Defined)	
Unit 3	**Object Oriented Programming in C#**	**5**
	3.1 Object Oriented Concepts 3.1.1 Classes and objects 3.1.2 Constructors and destructors 3.1.3 Method overloading 3.1.4 Inheritance 3.1.5 Polymorphism 3.1.6 Encapsulation 3.1.7 Abstract classes and interfaces 3.2 Overriding, Overloading	
Unit 4	**Collections, Comparisons and Conversions**	**3**
	4.1 Defining and using collections 4.2 Indexers, iterators 4.3 Type comparison, Value Comparison 4.4 Array operations 4.5 String handling	

	4.6 String methods	
Unit 5	**Exception Handling**	**3**
	5.1 Types of exceptions 5.2 try, catch, finally blocks 5.3 Creating user-defined exceptions	
Unit 6	**Windows Programming**	**6**
	6.1 Introduction to Windows Forms 6.2 Form design using Microsoft Visual Studio 6.3 Controls: • Label • TextBox • Button • RadioButton • CheckBox • ListBox 6.4 Event-driven programming	
Unit 7	**Database Connectivity using ADO.NET**	**5**
	8.1 Introduction to ADO.NET 8.2 Connecting with Microsoft SQL Server 8.3 Insert, update, delete, and display records	

Reference Books:

1. Beginning Visual C#, Wrox Publication, ISBN13: 978-0764543821

2. Professional Visual C#, Wrox Publication, ISBN13: 978-8126548538

3. Inside C#, by Tom Archer, Microsoft Press © 2001, ISBN: 0735612889

4. Beginning ASP.NET 3.5, Wrox Publication, ISBN13: 978-0470187593

5. Programming ASP.NET 3.5 by Jesse Liberty, Dan Maharry, Dan Hurwitz, O'Reilly, ISBN:9780596529567

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science)
(NEP 2024) Sem VI

Course Code: 24CsCmpU6204
Course Name: Lab Course on 24CsCmpU6203: C# DOTNET

Teaching Scheme: PR: 4 Hours/Week **Credit: 02**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Course Contents:

Sr.No	**List of practical**
1	**Introduction to .NET Environment** A. Installing and using Microsoft Visual Studio B. Creating first program in C#
2	**Basic Programs in C#** A. Using Flow of Control Statement B. Debugging and error handling C. Use of types of properties D. Use of Functions, Delegates E. Exception Handling F. Overriding, Overloading G. Number operations (prime, factorial, palindrome, perfect)
3	**Object Oriented Programming** A. Using Classes and objects B. Constructors C. Method overloading D. Inheritance E. Polymorphism F. Encapsulation
4	**Windows Forms Applications** A. Create simple Windows Forms application Use controls like: • Label • TextBox • Button

	• CheckBox • RadioButton • ListBox **B. Event Handling** • Button click events • Form events • Keyboard and mouse events
5	**Database Connectivity** A. Connecting .NET with Microsoft SQL Server B. Validation of Form C. Accessing Data with ADO.NET D. Use of ADO.NE I. Data Binding II.SQL Queries (Select,Update,Insert,Delete)
6	**Mini Project** Examples: Student Management System Library Management System Login and Registration system

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune - 5

Third Year of B.Sc. (Computer Science)

(2023 Course under NEP 2020)

Course Code : 24CsMatU6205 (Major Elective)

Course Name : Computational Geometry

Teaching Scheme: TH: 2 Hours/Week **Credit : 02**

Examination Scheme: CIA : 20 Marks **End-Sem : 30 Marks**

Prerequisites: Euclidean geometry, Trigonometry, Matrices, Algebra of equations.

Course Objectives: To study

- **Mathematical techniques required for computer graphic applications, especially principles of geometry and transformations.**
- **Apply transformations such as rotation, reflection, scaling, and shearing in 2D and 3D.**
- **Study concatenated transformations and their practical applications.**
- **Develop an understanding of homogeneous coordinates and their geometric interpretation.**
- **Explore transformations involving arbitrary points, lines, and axes.**
- **Understand projection techniques including orthographic, axonometric, oblique, and perspective projections.**
- **Study the mathematical representation and generation of standard plane curves.**
- **Develop problem-solving skills for computational geometry applications in graphics and modeling.**

Course Outcomes:

On completion of the course, student will be able to:-

- Represent geometric objects using matrices and homogeneous coordinates.
- Perform and analyze transformations of points, lines and polygons in two and three dimensions.
- Apply concatenated transformations to solve geometric problems.
- Implement transformations involving arbitrary points, lines and coordinate axes.
- Apply projection techniques to represent 3D objects on 2D planes.

- Generate and analyze standard plane curves such as circle, ellipse, parabola and hyperbola.
- Construct and evaluate Bézier curves for geometric modelling.
- Apply computational geometry concepts to solve real world problems in computer graphics and related domains.

Course Contents:

Chapter 1	**Two Dimensional Transformations**	**12 Hours**
	• Transformation and matrices. • Representation of points / objects. • Transformation of points / objects. • Midpoint transformation. • Transformation of straight lines. • Transformation of parallel lines. • Transformation of intersecting lines. • Transformation of polygon. • Transformations: Rotations, Reflections, Scaling, Shearing. • Concatenated transformations. • Transformation of the unit square. • Solid body transformations. • Translations and homogeneous coordinates. • Rotation about an arbitrary point. • Reflection through an arbitrary line. • Projection – A geometric interpretation of homogeneous coordinates. • Overall scaling. • Points at infinity.	
Chapter 2	**Three Dimensional Transformations**	**10 Hours**
	• Transformations: Rotations, Reflections, Scaling, Shearing. Translation. • Concatenated transformations. • Rotation about the local axis. • Transformation of a line to standard axis. • Rotation about an arbitrary axis in space. • Reflection through an arbitrary plane. • Affine and perspective geometry. • Orthographic projections and its applications. • Axonometric projections. • Oblique projections. • Perspective projection.	
Chapter 3	**Plane Curves**	**08 Hours**

	• Curve Representation. • Generation of circle. • Generation of an ellipse. • Generation of parabola. • Generation of hyperbola. • Bezier Curves.	
	Total No. of Hours	**30**

Reference Books:

1) Mathematical Elements for Computer Graphics by D. F. Rogers and J. A. Adams, Tata McGraw Hill, Second edition, 2002.

2) Schaum's Outlines, Computer Graphics, Tata McGraw Hill Publisher, Second edition, 2015.

3) Applied Geometry for Computer Graphics and CAD by Ducan Marsh, Springer Second edition, 2005.

4) Computer Graphics with OpenGL, Donald Hearn, M. Pauline Baker, Warren Carithers, Pearson, 4th Edition.

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
Third Year of B.Sc. (Computer Science)
(2023 Course under NEP 2020)

Course Code : 24CsMatU6206
Course Name : Lab Course on 24CsMatU6205 (Computational Geometry)
Teaching Scheme: PR: 4 Hours/Week **Credit : 02**
Examination Scheme: CIA : 20 Marks **End-Sem : 30 Marks**

Prerequisites: Euclidean Geometry, Trigonometry, Matrices, Algebra of Equations, Python programming language

Course Objectives: To study

- Mathematical techniques required for computer graphic applications, especially principles of geometry and transformations.
- Apply transformations such as rotation, reflection, scaling, and shearing in 2D and 3D.
- Study concatenated transformations and their practical applications.
- Develop an understanding of homogeneous coordinates and their geometric interpretation.
- Explore transformations involving arbitrary points, lines, and axes.
- Understand projection techniques including orthographic, axonometric, oblique, and perspective projections.
- Study the mathematical representation and generation of standard plane curves.
- Develop problem-solving skills for computational geometry applications in graphics and modeling.

Course Outcomes:

On completion of the course, student will be able to:-

- Represent geometric objects using matrices and homogeneous coordinates.
- Perform and analyze transformations of points, lines and polygons in two and three dimensions.
- Apply concatenated transformations to solve geometric problems.
- Implement transformations involving arbitrary points, lines and coordinate axes.
- Apply projection techniques to represent 3D objects on 2D planes.
- Generate and analyze standard plane curves such as circle, ellipse, parabola and hyperbola.
- Construct and evaluate Bézier curves for geometric modelling.
- Apply computational geometry concepts to solve real world problems in computer graphics and related domains.

	List of Practicals
Practical 1	2D Graphs
Practical 2	3D Graphs
Practical 3	Two dimensional Transformations I
Practical 4	Two dimensional transformations II
Practical 5	Three dimensional Transformations I
Practical 6	Three dimensional Transformations II
Practical 7	Orthographic projections
Practical 8	Axonometric projections
Practical 9	Oblique projections
Practical 10	Perspective Projections
Practical 11	Generation of Circle
Practical 12	Generation of Ellipse
Practical 13	Generation of parabola
Practical 14	Generation of hyperbola
Practical 15	Bezier Curve

Reference Books:

1) Mathematical Elements for Computer Graphics by D. F. Rogers and J. A. Adams, Tata McGraw Hill (Second edition), 2002.
2) Schaum's Outlines, Computer Graphics, Tata McGraw Hill Publisher (Second edition), 2015.
3) Applied Geometry for Computer Graphics and CAD by Ducan Marsh, Springer (Second edition), 2005.
4) Computer Graphics with OpenGL, Donald Hearn, M. Pauline Baker, Warren Carithers, Pearson (4^{th} Edition).

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous College), Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science) Major Elective: Electronics

(NEP 2024) SEMESTER VI

Course Code:- 24CsEleU6207

Course Name: Wireless sensor network and IOT (Major Elective)

Teaching Scheme: TH: 2 hrs / Week Credit : 02

Examination Scheme: CIA: 20 Marks End-Sem: 30 Marks

Prerequisites: Digital Electronics / Logic Design, Basic C/Python Programming, Microprocessors, Microcontroller / Basic Computer Architecture (helpful but not mandatory).

Course Objectives

1. Understand the concept and architecture of wireless sensor network.
2. Understand the sensor calibration and sensor interfacing with PIC/Raspberry pi microcontroller.
3. Know the different communication protocols for wireless sensor network.
4. Know the suitable network topology for implementation of wireless sensor network.
5. Apply the knowledge to real-world applications like environmental monitoring, home automation, or industrial sensing.

Course Outcomes

After completion of this course the volunteers will be able to -

1. Write the programmes for PIC microcontroller /Raspberry Pi platform
2. Develop the embedded firmware for PIC microcontroller /Raspberry Pi platform based system.
3. Select suitable wireless protocol for Wireless sensor network (WSN).
4. Develop wireless sensor node.
5. Develop suitable application of WSN.

Course content.

Unit 1	Introduction to wireless Sensor Networks	06 Lectures
	Definition of sensors, transducers, types of sensors. Definition of sensor network, history, applications of sensor network, block diagram of sensor network showing hardware and software components of WSN, Categories of WSN and their examples, Typical sensor network arrangement. Categorization of issues related to Sensors and their communication /computing architecture.	
Unit 2	Wireless Transmission technology and systems	08 Lectures
	Radio wave propagation, factors affecting radio propagation, multipath propagation, fade factors, Signal attenuation due to typical objects(exterior wood frame wall, Brick, exterior, concrete block, interior, Gypsum board, interior, wooden	

	floors, concrete floors) types of modulation(analog and digital: only principle and typical parameters),Available wireless protocols: 802.11,802.15.1/blutooth,802.15.4/Zigbee, Z-wave	
Unit 3	Protocols for wireless sensor networks	10 Lectures
	Medium Access Control(MAC): fundamentals, schedule-Based, Random access based ,sensor -MAC case study(periodic listen and sleep operations, scheduled selection and coordination, scheduled synchronisation adaptive listening, access control and data exchange, message passing Routing protocols: Data dissemination and gathering, Routing challenges and design issues, Routing strategies Transport protocols: TCP,UDP,CODA,ESRT,RMST,PSFQ,GARUDA,ATP	
Unit 4	Middleware and Operating systems for wireless sensor Networks	06Lectures
	Middleware for wireless sensor networks: WSN middleware principles, Existing middleware: MiLAN, IrisNet, AMF, DSware, CLMF, MSM, Dfuse, Impala, DDS Sensor ware Operating systems : TinyOs, Mate, MagnetOS, MANTIS, OSPM, EYES OS,SenOS, EMERALDS,PicOS	

Recommended References

1.Fundamentals of Wireless Sensor Networks: Theory and Practice - Waltenegus Dargie, Christian Poellabauer.
2.Protocols and Architectures for Wireless Sensor Networks - Holger Karl, Andreas Willig.
3.PIC Microcontroller Data Sheets (Microchip Technology).
4.Sensors and Actuators - D. Patranabis.

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous College), Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science) Major Elective: Electronics

(NEP 2024) SEMESTER VI

Course Code:- 24CsEleU6208

Course Name: Lab course on 24CsEleU6207 (WSN and IOT)

Teaching Scheme: PR: 4 hrs / Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Course Content :- Any 12 from following list

1.	Interfacing of LM 35 to raspberry Pi/PIC (Thing speak)
2.	Interfacing of LDR to raspberry pi/PIC (thing speak)
3.	Environmental monitoring using LoRa sensors
4.	IoT-based weather station (DHT11 + cloud visualization)(BlynkIoT)
5.	Bidirectional communication using Bluetooth (send & receive data)
6.	IoT-Based Air Pollution Monitoring System
7.	Writing IoT sensor data to CSV/JSON files Reading
8.	Publishing and subscribing sensor data using MQTT
9.	Storing IoT data using AWS S3.
10.	Interfacing of DHT11 to raspberry Pi /PIC
11.	Interfacing of Ultrasound to raspberry pi /PIC
12.	Interfacing of Pi camera to raspberry Pi/PIC
13.	Zigbee programming and configuration
14.	Sensor data routing using Zigbee
15.	Sensor data routing using Zigbee for different network topologies
16.	Data analysis and data presentation of WSN on IoT platform(Things Speak, Things board, Xively)
17.	WSN simulator /Python simulation
18.	IoT-Based Water Level Monitoring System
19.	Design and Implementation of End-to-End IoT-Based Weather Monitoring System with Cloud
20.	File handling and storage of IoT data using Python

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous College), Shivajinagar, Pune – 5

T.Y. B.Sc. (Computer Science)

(NEP 2024) SEMESTER VI

Course Code: 24CsCmpU6501

Course Name: Lab Course on Python Programming (VSC course)

Teaching Scheme: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Course Objectives

1. To introduce students to the fundamentals of Python programming and enable them to write and execute simple Python programs.
2. To develop problem-solving skills using decision-making and looping statements in Python.
3. To provide knowledge of string manipulation and Python data structures such as List, Tuple, Set, and Dictionary.
4. To understand the concepts of functions, exception handling, and file handling in Python programming.
5. To familiarize students with Python libraries such as NumPy and Pandas for data processing and analysis.
6. To enable students to develop a basic web application using the Django framework.

Course Outcomes

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

CO No	Course Outcomes(Practical)	Blooms Cognitive level
CO1	Write and execute basic Python programs using appropriate syntax and programming constructs.	**01**
CO2	Apply **decision-making and looping statements** to solve computational problems.	**02**
CO3	Perform **string manipulation and implement Python data structures** such as List, Tuple, Set, and Dictionary effectively.	**03**
CO4	Develop programs using **functions, exception handling, and file handling techniques**.	**04**
CO5	Use **NumPy and Pandas libraries** for data manipulation and analysis tasks.	**05**
CO6	Design and develop a **simple web application using the Django framework**.	**06**

Course Contents

Sr. No	Course Contents (Practical)
Ass 1	Writing and Executing Simple Python Programs
Ass 2	Programs based on decision making statements
Ass 3	Implementation of Looping statements
Ass 4	Program Based on String Manipulation (creation, indexing, slicing, operations)
Ass 5	Implementation of Python data Structures (List ,Tuple, Set and Dictionary)
Ass 6	Implementation of Functions and Exception Handling in Python
Ass 7	Implementation of File Handling
Ass 8	Implementation of Python Library I (Pandas)
Ass 9	Implementation of Python Library II (NumPy)
Ass 10	Developing a simple web application using Django Framework

********** *The End* **********