Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

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

Choice Based Credit System Syllabus
To be implemented from Academic Year
2020-2021

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

Semester III
(Total credits=22)

Course type	Paper Code	Paper title	Credits	Evaluation		
				CA	UE	TOTAL
CC-VIII	CS 231	Data Structures and Algorithms – I	2	15	35	50
	CS 232	Software Engineering	2	15	35	50
	CS 233	Practical course on CS 231 and CS 232	2	15	35	50
CC-IX		Mathematics - I	2	15	35	50
		Mathematics - II	2	15	35	50
		Practical course in Mathematics	2	15	35	50
CC-X		Electronics - I	2	15	35	50
		Electronics - II	2	15	35	50
		Practical course in Electronics	2	15	35	50
AECC-I		Environment Science – I	2			
AECC-II		Language Communication – I	2			

Semester IV

(Total credits=22)

Course type	Paper Code	Paper title	Credits	Evaluation		
				CA	UE	TOTAL
CC-XI	CS 241	Data Structures and Algorithms – II	2	15	35	50
	CS 242	Computer Networks - I	2	15	35	50
	CS 243	Practical course on CS 241 and CS 242	2	15	35	50
CC-XII		Mathematics - I	2	15	35	50
		Mathematics - II	2	15	35	50
		Practical course in Mathematics	2	15	35	50
CC-XIII		Electronics - I	2	15	35	50
		Electronics - II	2	15	35	50
		Practical course in Electronics	2	15	35	50
AECC-I		Environment Science – II	2			
AECC-II		Language Communication –II	2			

- Each theory Lecture time for S.Y. B.Sc Computer Science is of 50 min (3 lectures/ week for 2 credit course)
- Each practical session time for S.Y. B.Sc Computer Science is of 4 hrs 20 minutes (260 min)
- Practical batch size =12

Savitribai Phule Pune University S.Y.B.Sc. (Computer Science) Computer Science Paper - I Course Code: CS 231 Title : Data Structures and Algorithms – I		
Teaching Scheme 3 Lectures / week (50 mins duration)	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites:
Basic knowledge of algorithms and problem solving
Knowledge of C Programming Language

Course Objectives
1. To learn the systematic way of solving problem
2. To understand the different methods of organizing large amount of data
3. To efficiently implement the different data structures
4. To efficiently implement solutions for specific problems
5. To apply linear data structures.

Course Outcomes: On completion of the course, student will be able to
1. To use well-organized data structures in solving various problems.
2. To differentiate the usage of various structures in problem solution.
3. Implementing algorithms to solve problems using appropriate data structures.

Course Contents

Chapter 1	Introduction to Data Structures and Algorithm Analysis	4 lectures

1.1 Introduction
      1.1.1 Need of Data Structure
      1.1.2 Definitions - Data and information, Data type, Data object, ADT, Data Structure
      1.1.3 Types of Data Structures
1.2 Algorithm analysis
1.2.1 Space and time complexity, Graphical understanding of the relation between different functions of n, examples of linear loop, logarithmic,quadratic loop etc.
1.2.2 Best, Worst, Average case analysis, Asymptotic notations (Big O, Omega Ω, Theta θ), Problems on time complexity calculation.

Chapter 2	Array as a Data Structure	10 lectures

2.1 ADT of array, Operations
2.2Array applications - Searching
2.2.1 Sequential search, variations - Sentinel search, Probability search, ordered list
      search
      2.2.2 Binary Search
      2.2.3 Comparison of searching methods
2.3 Sorting Terminology- Internal, External, Stable, In-place Sorting
      2.3.1 Comparison Based Sorting - Lower bound on comparison based sorting, Methods- Bubble Sort, Insertion Sort,   Selection Sort, Algorithm design strategies - Divide and Conquer strategy, Merge Sort, Quick Sort, complexity analysis of sorting methods.

2.3.2 Non Comparison Based Sorting: Counting Sort, Radix Sort, complexity analysis.
2.3.3 Comparison of sorting methods

Chapter 3	Linked List	10 lectures

3.1 List as a Data Structure, differences with array.
3.2 Dynamic implementation of Linked List, internal and external pointers
3.3 Types of Linked List – Singly, Doubly, Circular
3.4 Operations on Linked List - create, traverse, insert, delete, search, sort, reverse, concatenate, merge, time complexity of operations.
3.5 Applications of Linked List – polynomial representation, Addition of two polynomials
3.6 Generalized linked list – concept, representation, multiple-variable polynomial representation using generalized list.

Chapter 4	Stack	6 lectures

4.1 Introduction
4.2 Operations – init(), push(), pop(), isEmpty(), isFull(), peek(), time complexity of operations.
4.3 Implementation- Static and Dynamic with comparison
4.4 Applications of stack
      4.4.1 Function call and recursion, String reversal, palindrome checking
      4.4.2 Expression types - infix, prefix and postfix, expression conversion and evaluation (implementation of infix to postfix, evaluation of postfix)
      4.4.3Backtracking strategy - 4 queens problem (implementation using stack)

Chapter 5	Queue	6 lectures

5.1 Introduction
5.2 Operations - init(), enqueue(), dequeue(), isEmpty(), isFull(), peek(),time complexity of operations, differences with stack.
5.3 Implementation - Static and Dynamic with comparison
5.4 Types of Queue - Linear Queue, Circular Queue, Priority Queue, Double Ended Queue (with implementation)
5.5 Applications – CPU Scheduling in multiprogramming environment, Round robin algorithm

Reference Books:

1. Classic Data Structures-D. Samanta, Prentice Hall India Pvt. Ltd.
2. Fundamentals of Data Structures in C- Ellis Horowitz, SartajSahni,Susan Anderson-Freed, 2nd Edition, Universities Press.
3. Data Structures using C and C++-YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Pearson Education
4. Data Structures: A Pseudo code approach with C, Richard Gilberg ,Behrouz A. Forouzan, Cengage Learning.
5. Introduction to Data Structures in C-Ashok Kamthane, Pearson Education
6. Algorithms and Data Structures, Niklaus Wirth, Pearson Education

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Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science)
Computer Science Paper -II
Course Code: CS 232
Title : Software Engineering
</td></tr>
</table>

Teaching Scheme 3 lectures / week (50 mins duration)	No. of Credits **2**	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
ER Modeling

Course Objectives

1. To get knowledge and understanding of software engineering discipline.
2. To learn analysis and design principles for software project development.

Course Outcomes
On completion of the course, student will be able to-
1. Compare and chose a process model for a software project development.
2. Identify requirements analyze and prepare models.
3. Prepare the SRS, Design document, Project plan of a given software system.

Course Contents

Chapter 1	Title : Introduction To Software Engineering and Process Models	8 lectures

1.1   Definition of Software
1.2 Nature of Software Engineering
1.3 Changing nature of software
1.4 Software Process
     1.4.1   The Process Framework
     1.4.2   Umbrella Activities
     1.4.3   Process Adaptation
1.5 Generic Process Model
1.6 Prescriptive Process Models
     1.6.1   The Waterfall Model
     1.6.2   Incremental Process Models
     1.6.3   Evolutionary Process Models
     1.6.4   Concurrent Models
     1.6.5   The Unified Process

Chapter 2	Title : Agile Development	5lectures

2.1 What is Agility?
2.2 Agile Process
   2.2.1 Agility Principles
   2.2.2 The Politics Of Agile Development
   2.2.3 Human Factors
2.3 Extreme Programming(XP)
   2.3.1XP Values
   2.3.2XP Process
   2.3.3 Industrial XP

2.4 Adaptive Software Development(ASD) 2.5 Scrum 2.6 Dynamic System Development Model (DSDM) 2.7 Agile Unified Process (AUP)	

Chapter 3	**Title : Requirements Analysis**	**7 lectures**

3.1 Requirement Elicitation,
 3.2 Software requirement specification (SRS)
     3.2.1 Developing Use Cases (UML)
 3.3 Building the Analysis Model
     3.3.1 Elements of the Analysis Model
     3.3.2 Analysis Patterns
     3.3.3 Agile Requirements Engineering
 3.4 Negotiating Requirements
 3.5 Validating Requirements		

Chapter 4	**Title : Requirements Modeling**	**10 lectures**

4.1 Introduction to UML
 4.2Structural Modeling
     4.2.1 Use case model
     4.2.2Class model
 4.3Behavioral Modeling
     4.3.1 Sequence model
     4.3.2 Activity model
     4.3.3 Communication or Collaboration model
 4.4 Architectural Modeling
     4.4.1 Component model
     4.4.2 Artifact model
     4.4.3 Deployment model		

Chapter 5	**Title :Design Concepts**	**6lectures**

5.1 Design Process
     5.1.1 Software Quality Guidelines and Attributes
     5.1.2 Evolution of Software Design
 5.2 Design Concepts
     5.2.1 Abstraction
     5.2.2 Architecture
     5.2.3 Patterns
     5.2.4 Separation of Concerns
     5.2.5 Modularity
     5.2.6 Information Hiding
     5.2.7 Functional Independence
     5.2.8 Refinement
     5.2.9 Aspects
     5.2.10 Refactoring
     5.2.11 Object Oriented Design Concepts
     5.2.12 Design Classes
     5.2.13 Dependency Inversion
     5.2.14 Design for Test
 5.3 The Design Model
     5.3.1 Data Design Elements
     5.3.2 Architectural Design Elements		

5.3.3 Interface Design Elements
5.3.4 Component-Level Diagram
5.4.5 Deployment-Level Diagram

Reference Books:
1. Software Engineering : A Practitioner's Approach - Roger S. Pressman, McGraw hill(Eighth Edition) ISBN-13: 978-0-07-802212-8, ISBN-10: 0-07-802212-6
2. A Concise Introduction to Software Engineering - Pankaj Jalote, Springer ISBN: 978-1-84800-301-9
3. The Unified Modeling Language Reference Manual - James Rambaugh, Ivar Jacobson, Grady Booch ISBN 0-201-30998-X

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science)
Computer Science Paper - III
Course Code: CS 233
Title : Practical course on CS 231 (Data Structures and Algorithms I) and CS 232 (Software Engineering)

Teaching Scheme 4 hrs 20 mins / week Batch Size : 12	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Operating Environment:
For Data Structures:
- **Operating system:** Linux
- **Editor:** Any linux based editor like vi, gedit etc.
- **Compiler** : cc or gcc

Lab Book:
The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Programming Assignments:
Programs should be done individually by the student intheir respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

Assessment:
Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include-timely completion, performance, innovation, efficient codes and good programming practices.

- **Internal Evaluation :**
    - 10 marks will be given based on a mini project of Software Engineering.
    - 5 marks will be allocated for Assignment completion and practical attendance.
- **University Evaluation :**
    - The Practical slip will be of 35 Marks which will be based on Data structures.

Course Contents:

Suggested Assignments for Data Structures – I

Assignment1: Searching Algorithms
Implementation of searching algorithms to search an element using: Linear Search, Sentinel Search, Binary Search (with time complexity)

Assignment 2:   **Sorting Algorithms - I**
Implementation of sorting algorithms: Bubble Sort, Insertion Sort, Selection Sort

Assignment 3:   **Sorting Algorithms - II**
Implementation of sorting algorithms: Quick Sort, Merge Sort , Counting Sort

Assignment 4:   Singly Linked List
1.   Dynamic implementation of Singly Linked List to perform following operations:
Create, Insert, Delete, Display, Search, Reverse
2. Create a list in the sorted order.

Assignment 5:   Doubly Linked List
    1.   Dynamic implementation of Doubly circular Linked List to perform following
        operations: Create, Insert, Delete, Display, Search

Assignment 6:   Linked List Applications
    1.   Merge two sorted lists.
Addition of two polynomials in a single variable.

Assignment 7:   Stack
1.   Static and Dynamic implementation of Stack to perform following operations: Init,
Push, Pop, Peek, Isempty, Isfull

Assignment 8:   Applications of Stack
1.   Implementation of an algorithm that reverses string of characters using stack and
checks whether a string is a palindrome.
2.   Infix to Postfix conversion.
3.   Evaluation of postfix expression.

Assignment 9:   Linear Queue
1.   Static and Dynamic implementation of linear Queue to perform following operations:
Init, enqueue, dequeue Peek, IsEmpty, IsFull.

Assignment 10:   Circular and Priority Queue
1.   Implementation of circular queue
2.   Implementation of priority queue

Suggested Assignments for Software Engineering mini Project	3

1. Prepare detailed statement of problem for the selected mini project
2. Identify suitable process model for the same.
3. Develop Software Requirement Specification for the project.
4. Identify scenarios and develop UML Use case
5. Other artifacts: Class Diagram, activity diagram, sequence diagram, component diagram and any other diagrams as applicable to the project.

Sample project titles: (These are just samples, students are suggested to take up different case studies)

1. Online mobile recharge system
2. Credit calculation system
3. Image sharing and editing system
4. Internal examination system
5. e-learning management system

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science)
Computer Science Paper - I
Course Code: CS 241
Title : DATA STRUCTURES AND ALGORITHMS-II

Teaching Scheme 3 Lectures / week (50 mins. duration)	No. of Credits 02	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites :
- Knowledge of C Programming Language
- Basic knowledge of algorithms
- Basic knowledge of linear data structures

Course Objectives
- To learn the systematic way of solving problems
- To design algorithms
- To understand the different methods of organizing large amount of data
- To efficiently implement the non-linear data structures

Course Outcomes: On completion of this course students will be able to
- Implementation of different data structures efficiently
- Usage of well-organized data structures to handle large amount of data
- Usage of appropriate data structures for problem solving

Course Contents

Chapter 1	**Tree**	**10 lectures**

1.1 Concept and Terminologies
1.2 Types of Binary trees - Binary tree, skewed tree, strictly binary tree, full binary tree, complete binary tree, expression tree, binary search tree, Heap
1.3 Representation – Static and Dynamic
1.4 Implementation and Operations on Binary Search Tree - Create, Insert, Delete, Search, Tree traversals– preorder, inorder, postorder (recursive implementation), Level-order traversal using queue, Counting leaf, non-leaf and total nodes, Copy, Mirror.
1.5 Applications of trees
    1.5.1 Heap sort, implementation
    1.5.2 Introduction to Greedy strategy, Huffman encoding (implementation using priority queue)

Chapter 2	**Efficient Search Trees**	**8 lectures**

2.1 Terminology: Balanced trees - AVL Trees, Red Black tree, splay tree, Lexical search tree -Trie
2.2 AVL Tree- concept and rotations
2.3 Red Black trees - concept, insertion and deletion.
2.4 Multi-way search tree - B and B+ tree - Insertion, Deletion

Chapter 3	**Graph**	**12 lectures**

3.1 Concept and terminologies
3.2 Graph Representation –Adjacency matrix, Adjacency list, Inverse Adjacency list, Adjacency multilist
3.3 Graph Traversals – Breadth First Search and Depth First Search (with implementation)
3.4 Applications of graph

3.4.1 Topological sorting

3.4.2 Use of Greedy Strategy in Minimal Spanning Trees (Prims and Kruskals algorithm)

3.4.3 Single source shortest path - Dijkstra's algorithm

3.4.4 Dynamic programming strategy, All pairs shortest path - Floyd Warshall algorithm

3.4.5 Use of graphs in social networks

Chapter 4	**Hash Table**	**6 lectures**

4.1 Concept of hashing

4.2 Terminologies – Hash table, Hash function, Bucket, Hash address, collision, synonym, overflow etc.

4.3 Properties of good hash function

4.4 Hash functions : division function, MID square , folding methods

4.5 Collision resolution techniques

    4.5.1 Open Addressing - Linear probing, quadratic probing, rehashing

    4.5.2 Chaining - Coalesced , separate chaining

Reference Books:

1. Fundamentals of Data Structures in C- Ellis Horowitz, SartajSahni,Susan Anderson-Freed, 2nd Edition, Universities Press.
2. Data Structures using C and C++-YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Pearson Education
3. Data Structures: A Pseudo code approach with C, Richard Gilberg ,Behrouz A. Forouzan, Cengage Learning.
4. Introduction to Data Structures in C-Ashok Kamthane, Pearson Education
5. Algorithms and Data Structures, Niklaus Wirth, Pearson Education
6. Introduction to Algorithms—Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein--MIT Press
7. Fundamentals of Computer Algorithms-- Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, Universities Press
8. The Algorithm Design Manual - Steven S Skiena, Springer

Savitribai Phule Pune University **S.Y.B.Sc. (Computer Science)** **Computer Science Paper - I Semester II** **Course Code: CS 242 Title : Computer Networks-I**		
Teaching Scheme 3 lectures / week (50 mins. duration)	No. of Credits **02**	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
Principles of Digital Electronics
Communication Principles

Course Objectives
To prepare students with basic networking concepts: data communication, protocolsand standards, various topologies and applications of network.

Course Outcomes
1. Have a good understanding of the OSI and TCP/IP Reference Models and in particular have a good knowledge of Layers.
2. Understand the working of various protocols.
3. Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies

Course Contents

Chapter 1	**Introduction to Networks and Network Models**	**4 lectures**

1.1 Data communication, components, data representation
1.2 Networks, network criteria, network types - LAN, WAN, Switching, The Internet, Accessing the Internet
1.3 Network Software- Protocol hierarchies, Design Issues of the layer, Connection Oriented and Connectionless Services,
1.4 Reference models - OSI Reference Models, TCP/IP Reference model, Connection devices in different layers, Comparison of OSI and TCP/IP Reference Models.

Chapter 2	**Lower Layers**	**10 lectures**

2.1 Communication at the physical layer, data rate limits - Noiseless channel (Nyquist bit rate), noisy channel (Shannon capacity), Performance - bandwidth, throughput, latency, bandwidth-delay product, jitter
2.2 Design issues of Data Link Layer, Services - Framing, flow control, error control, congestion control, Link layer addressing
2.3 Framing Methods - Character Count, Flag bytes with Byte Stuffing, Flags bits with Bit Stuffing, Physical Layer Coding Violations
2.4 The Channel allocation problem, Static and dynamic allocation, Media Access Methods - Taxonomy of multiple-access protocols
2.5 Switching and TCP/IP layers, Types - circuit switching, packet switching and message switching
2.6 Wired LANs - Standard Ethernet characteristics, Addressing, Access method, implementation, Fast and Gigabit Ethernet
2.7 Wireless LANs - Architectural comparison, Characteristics, Access control, IEEE 802.11

architecture, Physical layer, MAC sublayer, Bluetooth architecture, Layers

Chapter 3	**Network Layer**	**12 lectures**

3.1 Network layer services - Packetizing, Routing and forwarding, other services

3.2 Open and closed loop congestion control

3.3 IPv4 addressing- Address space, classful addressing, Subnetting, Supernetting, classless addressing, Network address resolution (NAT)

3.4 Forwarding of IP packets- based on destination address, based on label

3.5 Network Layer Protocols- Internet Protocol (IP), IPv4 datagram format, Fragmentation, options

3.6 Mobile IP-addressing, agents, Three phases

3.7 Next Generation IP- IPv6 address representation, address space, address types, IPv6 protocol, packet format, extension header, Difference between IPv4 and IPv6

3.8 Routing - General idea, Algorithms - Distance vector routing, link state routing, path-vector routing

Chapter 4	**Transport Layer**	**10 Lectures**

4.1 Transport layer Services- Process-to-process communication, Addressing, Encapsulation and decapsulation, Multiplexing and demultiplexing, Flow control, Pushing or pulling, Flow control, Buffers, Sequence numbers, Acknowledgements, sliding window, congestion control

4.2 Connectionless and Connection-oriented service, Port numbers

4.3 Transport layer protocols- User datagram protocol, user datagram, UDP services

4.4 Transmission Control Protocol - TCP Services, TCP Features, TCP Segment format, three-way handshake for connection establishment and termination, State transition diagram, windows in TCP.

Reference Books:

1. Computer Networks-Andrew S. Tanenbaum, 5th Edition, Pearson Education
2. Data Communication and Networking- BehrouzFourouzan, 5th Edition, McGraw Hill Pvt. Ltd.

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science)
Computer Science Paper - III
Course Code: CS 243
Title : Practical course on CS 241(Data Structures and Algorithms II) and CS 242
(Computer Networks I)</td></tr>
<tr><td align="center">Teaching Scheme
4 hrs 20 mins / week
Batch size : 12</td><td align="center">No. of Credits
2</td><td align="center">Examination Scheme
IE : 15 marks
UE: 35 marks</td></tr>
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Lab Book:

The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Programming Assignments:

Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

Assessment:

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include-timely completion, performance, innovation, efficient codes and good programming practices.

- **Internal Evaluation :**
    o 10 marks will be given based on Networking assignments.
    o 5 marks will be allocated for Assignment completion and practical attendance

- **University Evaluation :**
    o The Practical slip will be of 35 Marks which will be based on Advanced Data structures.

Operating Environment:

For Data Structures:

- **Operating system:** Linux
- **Editor:** Any linux based editor like vi, gedit etc.
- **Compiler** : cc or gcc

Course Contents :-

Assignment 1 Binary Search Tree and Traversals
1. Implement Binary Search Tree (BST) to perform following operations on BST–
   Create, Recursive Traversals - Inorder, Preorder, Postorder
2. Perform following operations: insert, delete

Assignment 2 Binary Search Tree Operations
1. Implement Binary Search Tree (BST) to perform following operations on BST–copy
   and mirror image of BST, counting leaf, non-leaf and total nodes.
2. Level-order traversal of binary search tree using queue.

Assignment 3 Applications of Binary Tree
1. Sort set of elements using Heap sort
2. Encode a set of characters using Huffman encoding

Assignment 4 Graph implementation
1. Implement Graph as adjacency matrix and adjacency list
2. Calculate indegree and outdegree of vertices
3. Graph traversals: BFS and DFS.

Assignment 5 Graph Applications - I
1. Implementation of Topological sorting
2. Implementation of Prims/Kruskals Minimum spanning tree algorithm

Assignment 6 Graph Applications - II
1. Implementation of Dijkstra's shortest path algorithm for finding Shortest Path from a
   given source vertex using adjacency cost matrix.
2. Implementation of Floyd Warshall algorithm for all pairs shortest path.

Assignment 7 Hash Table
1. Implementation of static hash table with Linear Probing.
2. Implementation of static hash table with chaining.

Assignment 8 Hash Table-2
1. Implementation of linked hash table with chaining.

Assignment 9 Networking Assignment

Assignment 10 Networking Assignment

University of Pune

Board of Studies in Mathematics

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

Syllabus of Mathematics

Introduction:

Savitribai Phule Pune University, Pune has decided to change the syllabi of various faculties from June, 2020. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects Board of studies in Mathematics with concern of teachers of Mathematics from different colleges affiliated to Savitribai Phule Pune University, Pune has prepared the syllabus of S.Y.B.Sc. Computer Science Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

i) Give the students a sufficient knowledge of fundamental principles ,methods and a clear perception of innumerous power of mathematical ideas and tools and know how to use them by modeling ,solving and interpreting.

ii) Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science.

iii) Enhancing students overall development and to equip them with mathematical modeling abilities, problem solving skills , creative talent and power of communication necessary for various kinds of employment .

iv) Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Objectives:

(i) A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.

(ii) A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.

(iii) A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.

(iv) A student be able to apply their skills and knowledge, that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.

(v) A student should be made aware of history of mathematics and hence of its past, present and future role as part of our culture.

* Medium of Instruction: English

* Eligibility: F.Y.B.Sc. Computer Science, as per University rules.

Structure of the course:

	Semester - I		Semester -II	
Paper I	MTC-231	Groups and Coding Theory	MTC-241	Computational Geometry
Paper II	MTC-232	Numerical Techniques	MTC-242	Operations Research
Paper III	MTC-233	Mathematics Practical: Python Programming Language-I	MTC-243	Mathematics Practical: Python Programming Language-II

* **All three above courses are compulsory.**

* External Students: Not allowed.

* Variation / Revaluation: Allowed for Paper- I and Paper-II.

* Qualifications for Teacher: M.Sc. Mathematics (with NET /SET as per existing rules)

Equivalence of Previous syllabus along with new syllabus:

	Semester-III		Semester-IV	
	New Course	Old Course	New Course	Old Course
Paper I	MTC-231: Groups and Coding Theory	MTC-211 : Applied Algebra	MTC-241: Computational Geometry	MTC-221: Computational Geometry
Paper II	MTC-232: Numerical Techniques	MTC-212: Numerical Analysis	MTC-242: Operations Research	MTC-222: Operations Research

Paper III	MTC-233: Mathematics Practical: Python Programming Language-I	MTC-213 : Mathematics Practical	MTC-243: Mathematics Practical: Python Programming Language-II	MTC–223: Mathematics Practical

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Semester III

MTC-231 : Groups and Coding Theory

Unit 1. Integers   **[05 Lectures]**
    1.1 Division Algorithm (without Proof)
    1.2 G.C.D. using division algorithm and expressing it as linear combination
    1.3 Euclid's lemma
    1.4 Equivalence relation (revision), Congruence relation on set of integers, Equivalence class partition

Unit 2. Groups   **[03 Lectures]**
    2.1 Binary Operation
    2.2 Group: Definition and Examples
    2.3 Elementary Properties of Groups

Unit 3. Finite Groups and Subgroups   **[10 Lectures]**
    3.1 Order of a group, order of an element
    3.2 Examples $(Zn, +)$ and $(U(n), *)$
    3.3 Subgroup definition, Finite subgroup test, subgroups of Zn
    3.4 Generator, cyclic group, finding generators of Zn(Corollary 3,4 without proof)
    3.5 Permutation group, definition, composition of two permutations, representation as product of disjoint cycles, inverse and order of a permutation, even/ odd permutation
    3.6 Cosets: Definition, Examples and Properties, Lagrange Theorem(without Proof)

Unit 4. Groups and Coding Theory   **[18 Lectures]**
    4.1 Coding of Binary Information and Error detection
    4.2 Decoding and Error Correction
    4.3 Public Key Cryptography

Text Books:-
1. Contemporary Abstract Algebra By J. A, Gallian (Seventh Edition)
    Unit 1:Chapter 0, Unit 2: Chapter 2, Unit 3: Chapter 3 ,4, 5 and 7
2. Discrete Mathematical Stuctures By Bernard Kolman, Robert C. Busby and Sharon Ross (6th Edition) Pearson Education Publication
    Unit 4: Chapter 11

MTC-232 : Numerical Techniques

Unit 1: Algebraic and Transcendental Equation   [04 Lectures]

    1.1 Introduction to Errors

    1.2 False Position Method

    1.3 Newton-Raphson Method

Unit 2: Calculus of Finite Differences and Interpolation   [16 Lectures]

    2.1 Differences

    2.2. Forward Differences

    2.3 Backward Differences

    2.4 Central Differences

    2.5 Other Differences (δ, μ operators)

    2.6 Properties of Operators

    2.7 Relation between Operators

    2.8 Newton's Gregory Formula for Forward Interpolation

    2.9 Newton's Gregory Formula for Backward Interpolation

    2.10 Lagrange's Interpolation Formula

    2.11 Divided Difference

    2.12 Newton's Divided Difference Formula

Unit 3: Numerical Integration   [08 Lectures]

    3.1 General Quadrature Formula

    3.2 Trapezoidal Rule

    3.3 Simpson's one-Third Rule

    3.4 Simpson's Three-Eight Rule

Unit 4: Numerical Solution of Ordinary Differential Equation   [08 Lectures]

    4.1 Euler's Method

    4.2 Euler's Modified Method

    4.3 Runge-Kutta Methods

Text Book:-

1. A textbook of Computer Based Numerical and Statistical Techniques, by A. K. Jaiswal and Anju Khandelwal. New Age International Publishers.

Unit 1: Chapter 2: Sec. 2.1, 2.5, 2.7
Unit 2: Chapter 3: Sec. 3.1, 3.2, 3.4, 3.5, Chapter 4: Sec. 4.1, 4.2, 4.3,
　　　　　Chapter 5: Sec. 5.1, 5.2, 5.4, 5.5
Unit 3: Chapter 6: Sec. 6.1, 6.3, 6.4, 6.5, 6.6, 6.7
Unit 4: Chapter 7: Sec. 7.1, 7.4, 7.5, 7.6

Reference Books:-
1. S.S. Sastry; Introductory Methods of Numerical Analysis, 3rd edition, Prentice Hall of India, 1999.
2. H.C. Saxena; Finite differences and Numerical Analysis, S. Chand and Company.
3. K.E. Atkinson; An Introduction to Numerical Analysis, Wiley Publications.
4. Balguruswamy; Numerical Analysis.

MTC-233: Mathematics Practical: Python Programming Language-I

Unit 1: Introduction to Python
　1.1 Installation of Python
　1.2 Values and types: int, float and str,
　1.3 Variables: assignment statements, printing variable values, types of variables.
　1.4 Operators, operands and precedence:+, -, /, *, **, % PEMDAS(Rules of precedence)
　1.5 String operations: + : Concatenation, * : Repetition
　1.6 Boolean operator:
　　　1.6.1 Comparison operators: ==, !=, >, =, <=
　　　1.6.2 Logical operators: and, or, not
　1.7 Mathematical functions from math, cmath modules.
　1.8 Keyboard input: input() statement

Unit 2: String, list, tuple
　2.1 Strings:
　　　2.1.1 Length (Len function)
　　　2.1.2 String traversal: Using while statement, Using for statement
　　　2.1.3 String slice
　　　2.1.4 Comparison operators (>, <, ==)
　2.2 Lists:
　　　2.2.1 List operations
　　　2.2.2 Use of range function
　　　2.2.3 Accessing list elements
　　　2.2.4 List membership and for loop
　　　2.2.5 List operations
　　　2.2.6 Updating list: addition, removal or updating of elements of a list

2.3 Tuples:

      2.3.1 Defining a tuple,

      2.3.2 Index operator,

      2.3.3 Slice operator,

      2.3.4 Tuple assignment,

      2.3.5 Tuple as a return value

Unit 3: Iterations and Conditional statements

3.1 Conditional and alternative statements, Chained and Nested Conditionals: if, if-else, if-elif-else, nested if, nested if-else

3.2 Looping statements such as while, for etc, Tables using while.

3.3 Functions:

      3.3.1 Calling functions: type, id

      3.3.2 Type conversion: int, float, str

      3.3.3 Composition of functions

      3.3.4 User defined functions, Parameters and arguments

Unit 4: Linear Algebra

4.1 Matrix construct, eye(n), zeros(n,m) matrices

4.2 Addition, Subtraction, Multiplication of matrices, powers and invers of a matrix.

4.3 Accessing Rows and Columns, Deleting and Inserting Rows and Columns

4.4 Determinant, reduced row echelon form, nullspace, columnspace, Rank

4.5 Solving systems of linear equations (Gauss Elimination Method, Gauss Jordan Method, LU- decomposition Method)

4.6 Eigenvalues, Eigenvectors, and Diagonalization

Unit 5: Numerical methods in Python

5.1 Roots of Equations

5.2 Newton-Raphson Method

5.3 False Position (Regula Falsi) Mehtod

5.4 Numerical Integration:

      5.1.1 Trapezoidal Rule,

      5.1.2 Simpson's $1/3^{rd}$ Rule,

      5.1.3 Simpson's $3/8^{th}$ Rule

Text Books:-

1. **Downey, A. et al., How to think like a Computer Scientist: Learning with Python, John Wiley, 2015.**
   Sections: 1, 2, 3
2. **Robert Johansson, Introduction to Scientific Computing in Python**
   Section: 4

Reference Books:-

1. **Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning India, 2015.**
2. **Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson**

India.
3. **Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015.**
4. **Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc.**
5. **Sandro Tosi, Matplotlib for Python Developers, Packt Publishing Ltd.(2009)**

Practicals:
Practical 1: Introduction to Python, Python Data Types-I (Unit 1)
Practical 2: Python Data Types- II (Unit 2)
Practical 3: Control statements in Python-I (Unit 3- 3.1, 3.2)
Practical 4: Control statements in Python-II (Unit 3- 3.3)
Practical 5: Application : Matrices (Unit 4 – 4.1-4.3)
Practical 6: Application : Determinants, system of Linear Equations (Unit 4- 4.4, 4.5)
Practical 7: Application : System of equations (Unit 4- 4.5)
Practical 8: Application : Eigenvalues, Eigenvectors (Unit 4 – 4.6)
Practical 9: Application : Eigenvalues, Eigenvectors (Unit 4 – 4.6)
Practical 10: Application : Roots of equations (Unit 5 – 5.1)
Practical 11: Application : Numerical integration (Unit 5 – 5.2, 5.3)
Practical 12: Application : Numerical integration (Unit 5 – 5.4)

Semester - IV

MTC-241: Computational Geometry
Unit 1. Two dimensional transformations: [12 Lectures]
    1.1 Introduction.
    1.2 Representation of points.
    1.3 Transformations and matrices.
    1.4 Transformation of points.
    1.5 Transformation of straight lines
    1.6 Midpoint Transformation
    1.7 Transformation of parallel lines
    1.8 Transformation of intersecting lines
    1.5 Transformation: rotations, reflections, scaling, shearing.
    1.6 Combined transformations.
    1.7 Transformation of a unit square.
    1.8 Solid body transformations.
    1.9 Translations and homogeneous coordinates.
    1.10 Rotation about an arbitrary point.
    1.11 Reflection through an arbitrary line.
Unit 2. Three dimensional transformations: [08 Lectures]
    2.1 Introduction.
    2.2 Three dimensional – Scaling, shearing, rotation, reflection, translation.
    2.3 Multiple transformations.
    2.4 Rotation about – an axis parallel to coordinate axes, an arbitrary line
    2.5 Reflection through – coordinate planes, planes parallel to coordinate
    planes , an arbitrary plane

Unit 3. **Projection**   **[08 Lectures]**
    3.1 Orthographic projections.
    3.2 Axonometric projections.
    3.3 Oblique projections
    3.4 Single point perspective projection
Unit 4. Plane and space Curves: **[08 Lectures]**
    4.1 Introduction.
    4.2 Curve representation.
    4.3 Parametric curves.
    4.4 Parametric representation of a circle and generation of circle.
    4.5 Bezier Curves – Introduction, definition, properties (without proof),
    Curve fitting (up to n = 3), equation of the curve in matrix form (upto n = 3)
Textbook:
1. D. F. Rogers, J. A. Adams, Mathematical elements for Computer graphics,
Mc Graw Hill Intnl Edition.
Unit 1: Chapter 2: Sec. 2-1 to 2.17
Unit 2: Chapter 3: Sec. 3.1 to 3.10,
Unit 3: Chapter 3: Sec. 3.12 to 3.14
Unit 4: Chapter 4: Sec. 4.1, 4.2, 4.5, Chapter 5: Sec. 5.1, 5.8
Reference books:
1. Computer Graphics with OpenGL, Donald Hearn, M. Pauline Baker, Warren Carithers,
    Pearson (4th Edition)
2. Schaum Series, Computer Graphics.

MTC-242: Operations Research

Unit 1: Linear Programming Problem I   **[12 Lectures]**
   1.1 Introduction Definition and Examples
   1.2 Problem solving using Graphical method
   1.3 Theory of Linear Programming, Slack and surplus variables, Standard form of LPP,
        Some important definitions, Assumptions in LPP, Limitations of Linear
        programming, Applications of Linear programming, Advantages of Linear
        programming Techniques
   1.4 Simplex method, Big- M-method
Unit 2: Linear Programming Problem II   **[08 Lectures]**
   2.1 Special cases of LPP : Alternative solution, Unbounded solution, Infeasible solution
   2.2 Duality in Linear Programming, Primal to dual conversion, Examples
Unit 3: Assignment Models   **[06 Lectures]**
   3.1 Assignmment Model -Introduction
   3.2 Hungerian method for Assignment problem
Unit 4: Transportation Models   **[10 Lectures]**
    4.1 Introduction, Tabular representation

4.2 Methods of IBFS (North-West rule, Matrix-minima, Vogel's Approximation), Algorithms

4.3 The Optimality Test of Transportation Model (MODI method only)

Text Book:-

Operation Research (12 th Edition), by S.D.Sharma.

  Unit 1: Chapter 1: Sec. 1.1, 1.3-1, 1.3-2, 1.5, 1.6, 1.8, 1.9, 1.10, 1.11, 1.12,
     Chapter 3: Sec. 3.1, 3.2, 3.3, 3. 4, 3.5-4,
  Unit 2: Chapter 3: Sec. 3.8-1,3.8-2, Chapter 5: Sec. 5.1-1, 5.2-1,5.3,5.7-1, 5.7-2
  Unit 3: Chapter 9: Sec. 9.1, 9.2, 9.4-1, 9.4-2, 9.5, 9.6, 9.7-1, 9.7-2
  Unit 4: Chapter 10: 10.1, 10.2, 10.5, 10.8-1,10.9, 10.10

Reference Books:-

1. Operations Research by H. A. Taha
2. Operations Research by R. Panneerselvam, Prentice Hall of India.
3. Principles of Operations Research by H. M. Wagner, Prentice Hall of India.
4. Operations Research by Gupta and Hira.
5. Operation Research by J.K. Sharma

MTC-243: Mathematics Practical: Python Programming Language-II

Unit 1: 2D, 3D Graphs

 1.1 Installation of numpy, matplotlib packages
 1.2 Graphs plotting of functions such as ... etc.
 1.3 Different formats of graphs.
 1.3 Three-dimensional Points and Lines
 1.4 Three-dimensional Contour Plots
 1.5 Wireframes and Surface Plots
 1.6 Graphs plotting of functions such as... etc.

Unit 2: Computational Geometry

 1.1 Points: The distance between two points, Lists of Points - the PointList class, Integer point lists, Ordered Point sets, Extreme Points of a PointList, Random sets of Points not in general position
 2.2 Points: Displaying Points and other geometrical objects, Lines, rays, and line segments, The geometry of line segments, Displaying lines, rays and line segments
 2.3 Polygon : Representing polygons in Python, Triangles, Signed area of a triangle, Triangles and the relationships of points to lines, is Collinear, is Left, is Left On, is Right, is Right On, Between
 2.4 Two dimensional rotation and reflection
 2.5 Three dimensional rotation and reflection
 2.6 Generation of Bezier curve with given control points

Unit 3: Study of Operational Research in Python

3.1 Linear Programming in Python
3.2 Introduction to Simplex Method in Python

Practicals:
Practical 1: Graph Plotting (Unit 1 – 1.1 – 1.3)
Practical 2: Graph Plotting (Unit 1 – 1.4 – 1.7)
Practical 3: Application to Computational Geometry (Unit 2 – 2.1)
Practical 4: Application to Computational Geometry (Unit 2 – 2.2)
Practical 5: Application to Computational Geometry (Unit 2 – 2.3)
Practical 6: Study of Graphical aspects of Two dimensional transformation matrix using matplotlib
Practical 7: Study of Graphical aspects of Three dimensional transformation matrix using matplotlib
Practical 8: Study of Graphical aspects of Three dimensional transformation matrix using matplotlib
Practical 9: Study of effect of concatenation of Two dimensional and Three dimensional transformations
Practical 10: Generation of Bezier curve using given control points
Practical 11: Study of Operational Research in Python (Unit 3.1)
Practical 12: Study of Operational Research in Python (Unit 3.2)

Text Books:-

1. **Jaan Kiusalaas, Numerical Methods in Engineering with Python, Cambridge University Press, (2005)**
   Sections: 3
2. **Robert Johansson, Introduction to Scientific Computing in Python**
   Section: 1
3. **Jason Brownlee, Basics of Linear Algebra for Machine Learning, Discover the Mathematical Language of Data in Python**
   Sections: 2

Reference Books:-

1. **Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning India, 2015.**
2. **Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson India.**
3. **Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015.**
4. **Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle and Associates Inc.**
5. **Jim Arlow, Interactive Computational Geometry in Python**

Note:
(i) In paper -I , paper-II and paper-III, each course is of 50 marks (35 marks theory and 15 marks internal examination).

(ii) Paper III: Mathematics Practical - MTC-233 and MTC-243 is practical course and

is of 50 marks. Practicals shall be perforemed on computer.

Examination:

A) Pattern of examination: Paper- I, Paper-II and paper-III: Semesterwise

B) Pattern of question papers: For Paper -I and Paper-II
    Q 1. Attempt any 05 out of 07 questions each of 01 marks. [05 Marks]
    Q 2. Attempt any 02 out of 04 questions each of 05 marks. [10 Marks]
    Q 3. Attempt any 02 out of 04 questions each of 05 marks. [10 Marks]
    Q 4. Attempt any 02 out of 04 questions each of 10 marks. [10 Marks]

C) Instructions Regarding Practical:
    Paper-III:Mathematics Practical:
            (i) Mathematics Practical, external examiner shall be appointed by
              Savitribai Phule Pune University, Pune.
            (ii) The minimum duration of parctical examination is 3 hours.
            (iii) The semester examination is of 35 marks 15 marks are from internal
              evaluation (Journal, attendence and viva-voce or internal test etc.)
            (iv) The slips for the questions on programming and problem solving
              using python shall be prepared and provided and these can be used
              at least for 3 years.

D) Standard of passing:
    For Paper- I, Paper-II and Papaer -III: 14 Marks out of 35 and 06 marks out of 15
    marks and total should be 20 marks for each course.

SAVITRIBAI PHULE PUNE UNIVERSITY

(Formerly University of Pune)

S.Y. B. Sc. (Computer Science), Electronics

Choice Based Credit System Syllabus

To be implemented from

Academic Year 2020–2021

(Under the faculty of Science and Technology)

Savitribai Phule Pune University

(Formerly University of Pune)

SYLLABUS OF

S. Y. B. Sc. (Computer Science), Electronics

Choice Based Credit System

To be implemented from A.Y. 2020-21

Structure of S. Y. B. Sc.(Computer Science) Electronics

Semester	Paper Code	Paper	Paper title	No. of Credit	Lectures/Week	Evaluation		
						CA	UE	Total
III	ELC-231	I	Microcontroller Architecture & Programming	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-232	II	Digital Communication and Networking	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-233	III	Practical Course I	2	1 pract / week (each practical of 04 hours & 20 minutes)	15	35	50
IV	ELC-241	I	Embedded System Design	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-242	II	Wireless Communication and Internet of Things	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-243	III	Practical Course II	2	1 pract / week (each practical of 04 hours & 20 minutes)	15	35	50

S.Y.B.Sc.(Computer Science), Electronics- Semester III
Paper-I: Microcontroller Architecture & Programming (ELC 231)

Objectives:

1. To study the basics of 8051microcontroller
2. To study the Programming of8051microcontroller
3. To study the interfacing techniques of 8051microcontroller
4. To design different application circuits using 8051microcontroller

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

1. To write programs for 8051 microcontroller
2. To interface I/O peripherals to 8051 microcontroller
3. To design small microcontroller based projects

COURSE CONTENTS

UNIT- 1: Basics of Microcontroller & Intel 8051 architecture   [08]

Introduction to microcontrollers, difference in controller and processor.
Architecture of 8051, Internal block diagram, Internal RAM organization, SFRS, pin functions of 8051, I/O port structure & Operation, External Memory Interface.

UNIT-2: Programming model of 8051   [10]

Instruction classification, Instruction set, Addressing Modes: Immediate, register, direct, indirect and relative, assembler directives (ORG, END), features with examples, I/O Bit & Byte programming using assembly language for LED and seven segment display (SSD) interfacing.
Introduction to 8051 programming in C.

UNIT- 3: Timer /Counter, Interrupts   [10]

Timer / counter: TMOD, TCON, SCON, SBUF, PCON Registers, Timer modes, programming for time delay using mode 1 and mode 2.
Interrupts: Introduction to interrupt, Interrupt types and their vector addresses, Interrupt enable register and interrupt priority register (IE, IP)

UNIT- 4: Interfacing, Serial Communication   **[08]**

Programming of serial port without interrupt, Serial Communication: Synchronous and asynchronous serial communication, Use of timer to select baud rate for serial communication. Interfacing : ADC, DAC, LCD, stepper motor.

Recommended books:

1.   8051 microcontroller and Embedded system using assembly and C : Mazidi and McKinley, Pearson publications
2.   The 8051 microcontroller – Architecture, programming and applications: K.Uma Rao and Andhe Pallavi, Pearson publications.

S.Y.B.Sc. Computer Science), Electronics, Semester III
Paper-II, Digital Communication and Networking, ELC- 232

Objectives:

1.   To introduce to all aspects of data communication system
2.   To introduce various digital modulation schemes
3.   To identify the need of data coding and error detection/correction mechanism.
4.   To study bandwidth utilization techniques : multiplexing and Spectrum spreading
5.   To know data link layer protocol: Media Access Control
6.   To study OSI and TCP/IP models of Networking.

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

1.   Define and explain terminologies of data communication
2.   Understand the impact and limitations of various digital modulation techniques
3.   To acknowledge the need of spread spectrum schemes.
4.   Identify functions of data link layer and network layer while accessing communication link
5.   To choose appropriate and advanced techniques to build the computer network

.

COURSE CONTENTS

UNIT 1: Introduction to Electronic Communication   **(9)**

Introduction to Communication: Elements of Communication system, types of noise sources, Electromagnetic spectrum, signal and channel bandwidth,

Types of communication: simplex, half duplex, full duplex, baseband and broadband,

Serial communication: asynchronous and synchronous,

Information Theory: Information entropy, rate of information (data rate, baud rate), channel capacity, Nyquist theorem, Signal to noise ratio, Noise Figure, Shannon theorem,

Error handling codes: Necessity, Hamming code, CRC

UNIT 2: Modulation and Demodulation   **(5)**

Introduction to modulation and demodulation: Concept and need of modulation and demodulation,

Digital Modulation techniques: Pulse Code Modulation (PCM), FSK, QPSK, QAM.

UNIT 3: Multiplexing, Spectrum Spreading and Media Access Control   (12)

Multiplexing techniques: Frequency division multiplexing, wavelength division multiplexing, Time division multiplexing

Spread Spectrum techniques: Frequency hopping Spread Spectrum, Direct Sequence Spread Spectrum

Media Access Control (MAC):

Random Access Protocol: ALOHA, CSMA, CSMA/CD, CSMA/CA,

Controlled Access Protocols: Reservation, Polling, Token passing,

Channelization Protocols: FDMA, TDMA, CDMA.

UNIT 4: Computer Networking   (10)

Introduction to computer networks

Types of networks : LAN, MAN, WAN, Wireless networks, Switching, Internet,

Network topology : point to point, Star, Ring, Bus, Mesh, Tree, Daisy Chain, Hybrid

Network devices : Repeater, Switch, Networking cables, Router, Bridge, Hub, Brouter, Gateway.

Wired LANs:-

Ethernet: Ethernet protocol, standard Ethernet, 100 MBPS Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet,

Computer network model: OSI and TCP/IP.

Recommended books:

1. Communication Electronics: Principles and Applications, Frenzel, Tata Mc Graw Hill publication, 5th edition.

2. Data Communication and Networking, Forouzan, Mc Graw Hill publication, 5th edition

3. Computer Networks, Tanenbaum, pHI publication, 5th edition

S.Y.B.Sc.(Computer Science), Electronics, Semester III
Paper III, Practical Course (ELC-233)

Objectives:
1. To get hands on training of Embedded C
2. To study experimentally interfacing of microcontroller
3. To design, build and test modulator and demodulators of digital communication
4. To build and test experimentally various techniques of wired communication
5. To develop practical skills of network setup

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

1. To design and build his/her own microcontroller based projects.
2. To acquire skills of Embedded C programming
3. To know multiplexing and modulation techniques useful in developing wireless application
4. Do build and test own network and do settings.

Guidelines for Practical:

- Practical batch size : 12
- Minimum no of Practical to be performed : 10
- At least five practical from each Group
- Electronics lab should have set up for embedded programming (Computers and microcontroller target and interfacing boards)

COURSE CONTENTS

Group A: (Any 5)

1. Arithmetic, logical & code conversion problems using assembly/C programming
2. Interfacing of thumbwheel & seven segment display to 8051 microcontroller
3. Traffic light controller using 8051 microcontroller
4. Interfacing LCD to 8051Microcontroller
5. Waveform generation using DAC Interface to 8051Microcontroller

6.   Event counter using opto-coupler, seven segment LED/LCD display interface to 8051Microcontroller

7.   Speed Control of stepper motor using 8051 microcontroller

Group B: (Any 5)

1. Study of 3 or 4 Bit Pulse Code Modulation technique

2. Study of Frequency Shift Keying

3. Study of Time Division Multiplexing

4. Study of Frequency Division Multiplexing

5. Study of Code Division Multiple Access System

6. Study of Error detection and correction by using Hamming Code technique

7. Study of Computer network components : Cables, Connectors, Routers, Switches, Ethernet and related interfacing cards

8. To study Configuration of IP and MAC address and to study Local Area Network setup

S.Y.B. Sc. (Computer Science), Electronics, Semester IV
Paper I : Embedded System Design (ELC-241)

Objectives:
1. To understand the concept of Embedded systems.
2. To study the design flow and available tools for an Embedded system.
3. To understand the implementation of embedded system using firmware and hardware components.
4. To acquire programming skills for the development of Embedded system design.
5. To develop practical skills for designing embedded system Applications.

Course Outcomes : On completion of the course, student will be able
1. To understand the difference between general computing and the Embedded systems.
2. To know the fundamentals of embedded systems.
3. Understand the use of Single board Computer (Such as Raspberry Pi) for an embedded system application.
4. Familiar with the programming environment to develop embedded systems and their interfaces with peripheral devices.
5. To develop familiarity with tools used to develop in an embedded environment.

COURSE CONTENTS

Unit 1:Introduction to Embedded systems using single board computers (SBC)   (08)

Single boards computer block diagram, types, Comparison of SBC models, Specifications, I/O devices (Storage, display, keyboard and mouse), Network access devices

Unit 2: Architecture of System on Chip (SOC)   (08)

Architecture of SoC, Basic version Broad Coprocessor, Pin Description of Raspberry Pi, Architectural features: CPU Overview, CPU Pipeline stages, CPU Cache Organization, Branch Prediction & Folding (Concept), GPU Overview

Unit 3:Programming using Python   (10)

Overview of Rasberian OS (Operating System), Installation, different types of Operating Systems

Basic Python Programming (Script programming):Variable & data types, Flow Control structures, Conditional statements (If…Then…else),

Functions: I/O function (GPIO, Digital),Time functions, Library functions

Basic Arithmetic Programs: Addition, Subtraction, Multiplication, Division

Unit 4 : Interfacing of devices using Python Programming   (10)

Basic interfacing: LED, Switch, LCD

Internal Advanced: Bluetooth, Wifi, Ethernet,

External advanced: Camera, Serial Communication GSM, Ultrasonic Sensor, PIR, Finger Print reader.

Recommended Books:

1. Rasberry Pi CookBook: Software & Hardware problems and Solutions By Simon Monk(O'Reilly Media Inc.)
2. Raspberry Pi Hardware Reference by Warren Gay (Apress)
3. Rasberry Pi User Guide By Eben Upton, Greath Halfacree (John Wiley & Sons, Inc.)
4. Learning Python with Rasberry Pi, by Alex Bradbury, Ben Everard, John Wiley & Sons, Inc
5. Learn Raspberry Pi programming with Python By Wolfram Donat (Apress)

S.Y.B.Sc.(Computer Science), Electronics, Semester IV
Paper II: Wireless Communication and Internet of Things (ELC242)

Objectives:

1. To learn and understand applications of wireless communication system

2. To learn and understand cellular system

3. To learn and understand architecture of short range Wireless Technologies

4. To learn and understand basics of Internet of Things

5. To study applications of IoT

Course Outcomes: Students will be able to

1. Know working of wireless technologies such as Mobile communication, GSM, GPRS

2. Become familiar with 3G and 4G Cellular Network Technologies for Data Connections.

3. Understand working principles of short range communication application

4. Get introduce to upcoming technology of Internet of Things

5. Explore themselves and develop new IoT based applications

COURSE CONTENTS

Unit1: Wireless Communication: Cellular Telephony (12)

Overview of wireless communication,

Introduction of cellular telephony system: Frequency reuse, handoff strategies, Co-channel and adjacent channel interference, block diagram of mobile handset

Overview of Cellular Telephony generations: 1G to 5G,3G (W-CDMA, UMTS), 4G(LTE)

GSM: architecture, frame structure, mobility management,

GPRS : architecture, application

Unit 2 : Short Range Wireless Technologies and Location Tracking   **(12)**

Short range Technologies :

    Bluetooth: Bluetooth architecture, Bluetooth protocol stack, Bluetooth frame structure

    Zigbee: Architecture, topologies, applications, Z wave: Protocol architecture, applications

    RFID: working of RFID system, types of RFID tags, RFID frequencies, applications

Location Tracking: GPS system**:** components of GPS system (space segment, control segment, user segment), GPS receiver, Applications

Unit 3: IoT Architecture   **(08)**

Introduction to IOT : Evolution of IOT, M2M and/or IOT, Seven layer architecture of IoT, Role of cloud in IoT, cloud topologies, Cloud access, Protocols in IoT, Cross connectivity across IoT system components:

- Device to Gateway-short range Wireless: cellphone as gateway, dedicated wireless Access points
- Gateway to cloud: Long range connectivity, (wired, cellular, Satellite, WAN)
- Direct Device to Cloud connectivity ,

Networking technologies: Low power local area networking (LPLAN), Low power wide area networking (LPWAN) technologies, comparison of LoRa, sigfox NB-IoT, Cat –M.

Unit 4: IoT Applications   **(04)**

Application domains,

Challenges in IoT : Power consumption, Physical security, durability, Secure Connectivity, Secure Data Storage, Data volume, Scalability

Case studies:

    Case Study 1: Smart Irrigation system for Agricultural field

    Case Study 2:Home Automation

    Case Study 3: Smart Cities

Recommended books:

1. Wireless Communications Principles and Practice, Rappaport, Pearson publication

2. Mobile Communications, Jochen Schiller, Pearson publication

3. Internet of Things : Principles and Paradigms, Rajkumar Buyya and Dastjerdi, MK publishers

4. Internet of Things, Mayur Ramgir, Pearson publication

S.Y.B.Sc.(Computer Science), Electronics, Semester IV
Paper III, Practical Course (ELC-243)

Objectives:

1. To use basic concepts for building various applications of embedded electronics.
2. To build experimental setup and test the circuits.
3. To develop skills of analyzing test results of given experiments.
4. Developing Trained Personals for educating and training for upcoming graduates in wireless communication.
5. Implement basic IoT applications on embedded platform

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

1. To design and develop own smart applications using Rasberry-Pi
2. To write Python program for simple applications
3. To build own IoT based system

Guidelines :

- Practical batch size : 12
- Minimum no of Practical to be performed : 10
- Eight compulsory experiments: At least four practical from each Group
- One activity equivalent to 2 experiments by the student.
    - a. Continuation of F. Y. activity.
    - b. Electronics project Based on the Theory Courses learnt
    - c. Documentation type experiments
    - d. Presentation/Seminar on Electronics /advanced topic/research topics.

Prerequisite: Rasberry Pi boards, Arduino / LoRa boards

COURSE CONTENTS

Group A (any 4)

1. Programming of Raspberry Pi to control LEDs attached to the GPIO pins

2. Programming of Raspberry Pi to get feedback from a switch connected to the GPIO pins

3. Programming of Raspberry Pi to detect temperature using temperature sensor

4. Programming of Raspberry Pi to detect light intensity using photocell sensor

5. Programming of Raspberry Pi for Motion detection

6. Programming of Raspberry Pi for image detection

Group B (any 4)

1. Study of GSM system (Message transmission & Reception).

2. To study working of SIM card in GSM handset

3. Study of GPRS system

4. Study of Zig-bee for one application

5. Study of RFID system

6. Introduction to Python programming.

7. To study Arduino based LED switching using mobile

8. Temperature and humidity sensing using Arduino

9. LoRa Interfacing.

SYBSC & SYBSC (Computer Science)

ENGLISH

(Ability Enhancement Compulsory Course-AECC)

(Choice Based Credit System-35:15-Pattern)
(w. e. f- 2020- 2021)

(02-Credit Course)

Text: *Horizons: English in Multivalent Contexts* (Board of Editors- Orient BlackSwan)

Preamble:

This is an ABILITY ENHANCEMENT COURSE. Considering the needs of students and the requirements of professional sectors, the syllabus of this paper is designed to enhance linguistic and professional skills of the students. In the age of technology, it's high time for the students to acquire and exercise the skill and sub-skills of using English in multivalent contexts.

The paper aims at a balanced up-gradation of the students, focussing on their ability enhancement. Hence, to avoid a lopsided professional development, the humane values are also taken care of by accommodating literature section in the syllabus. The other units cater to the needs of enhancing speaking ability, writing ability, the ability to face an interview, the ability of using soft skills effectively while planning one's work and working on the plans. By and large, the present syllabus is an attempt to galvanise the existing competencies of the students and enhancing their abilities for a better performance and better results.

Objectives:

1. To introduce the use of English in multimedia
2. To acquaint the students with the language skills in multivalent contexts
3. To acquaint and enlighten students regarding the speaking skill in various contexts
4. To acquaint and familiarize the students with advanced writing skills in different contexts
5. To acquaint and familiarize the students with soft skills
6. To minimize the gap between the existing communicative skills of the students and the skills they require at professional level
7. To develop competence among the students to appreciate and analyze short stories and poetry

Semester-III

Text: *Horizons: English in Multivalent Contexts* (Board of Editors- Orient BlackSwan)

Content-

UNIT-I- LITERATURE   10 Clock Hours

1. **Short Story:**
   i) 'A Shadow': R. K. Narayan
2. **Poetry:**
   i) La Belle Dame sans Merci: John Keats
   ii) Where the Mind is without Fear: Rabindranath Tagore

UNIT-II-CONVERSATIONAL SKILL   10 Clock Hours

(Sample Dialogues, Useful Expressions and Exercises)

1. Introducing Yourself and Others
2. Asking, Giving and Refusing Permission
3. Describing Daily Routine
4. Complaining and Apologizing
5.

UNIT-III-INTERVIEW TECHNIQUES   10 Clock Hours

1. Job Application Letter
2. Resume Writing
3. GDPI
4. Presentations

Semester-IV

Text: *Horizons: English in Multivalent Context* (Board of Editors- Orient BlackSwan)

UNIT-I-LITERATURE   10 Clock Hours

1. **Short Story:**
   i) My Lost Dollar: Stephen Leacock

2. **Poetry:**
   i) The Bird Sanctuary: Sarojini Naidu

   ii) Stopping by Woods on a Snowy Evening: Robert Frost

UNIT-II-WRITING SKILLS   10 Clock Hours

(Sample Passages, Useful Techniques and Exercises)

1. Notices
2. Agenda
3. Minutes
4. Content Writing

UNIT-III-SOFT SKILLS AND PERSONALITY DEVELOPMENT

(Sample Situations, Useful Techniques and Exercises)   **10 Clock Hours**

1. An Introduction to Soft Skills

2. SWOC Analysis

3. Goal Setting

4. Project Management

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WEB LINKS:

http://networketiquette.net/

https://public.wsu.edu/~brians/errors/

http://users3.ev1.net/~pamthompson/body_language.htm

http://www.albion.com/netiquette/corerules.html

http://www.bbc.co.uk/worldservice/learningenglish/radio/specials/1535_questionanswer/page15.shtml

http://www.colostate.edu/Depts/Speech/rccs/theory44.html

http://www.dailywritingtips.com/

EVALUATION PATTERN

Considering the choice-based credit system (CBCS) and the semester pattern, both Semesters-III & IV will have a uniform evaluation pattern of **50 marks** each. There will be an **'Internal Examination'** for **15 marks** and **Semester-end Examination** for **35 marks**.

The Internal Examination for **15 marks** will be conducted in two parts.

1) Practical Examination for 05 marks:

(The choices like Group Discussion, Mock Interviews, Seminar, Project Presentation, Role Play, Home Assignment, Library Work, Lecture Notes etc. can be considered.)

2) A Mid-semester Written Test for 10 marks:

The Mid-semester Written Test will be based on the book prescribed for the syllabus. The test aims at assessing students' writing competence in general. Hence, descriptive and essay type questions can be considered while setting the question paper.

Semester-end Examination:

The Semester-end Examination will have a uniform question paper pattern for both semesters. The pattern of the question paper is given below.

Question Paper Patterns (III & IV)

Marks: 35   **Time: 2 Clock Hours**

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Instructions:

1. All questions are compulsory.

2. Figures to the right indicate full marks.

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Q.1) Long-answer question on Unit-1

    (Any 1 out of 2)   (15)

Q.2) Short notes on Unit-2

    (Any 2 out of 3)   (10)

Q.3) Short notes on Unit-3

    (Any 2 out of 3)   (10)

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