Semester-2

Type	Code	COMMUNICATIVE ENGLISH	L-T-P	Credits	Marks
CS	AECC-2		3-1-0	4	100
Topic Objective		To learn the basics of Communication. To make students proficient in it. To develop the abilities for listening, speaking, reading, and writing.			
Prerequisites		Confidence, Vocabulary, Overcoming your fear of failure, Knowledge of Grammar, Personal Communication, Professional Communication.			
Lecture Scheme		Regular lectures (classroom /virtual class with Laptop/Desktop/Smartphone) with use of ICT, lectures are planned to be interactive with focus on problem solving activities.			

Evaluation Scheme

Internal Assessment			Written Assessment	Total
Assignment(s)	Unit Test	Mid-Term (Written)	End-Term	
5	0	20	60	80

University Syllabus

Unit No	Topics	Hours
Unit-1	**Introduction:** (i) What is communication? (ii) Types of communication (Horizontal, Vertical, Interpersonal, Grapevine), (iii)Uses of Communication, Inter-cultural communication, Communication today: (iv)Distinct features of Indianisation, alternative texts of language learning, global English and English in the print and electronic media in India.	10
Unit-2	**The Four Skills and Prospect of new material in language learning:** (i) Listening-Passive and active, Speaking effective, intelligibility and clarity (ii) Methods and techniques of reading such as skimming, scanning and searching for information; Reading to understand the literal, metaphorical and suggested meaning of a passage, (iii) Identifying the tone (admiring, accusatory, ironical, sympathetic, evasive, indecisive, ambiguous, neutral etc.) of the writer and view-points. (iv) Cohesive and Coherent writing	10
Unit-3	**Grammatical and Composition Skills:** (i) Doing exercises like filling in the blanks, correcting errors, choosing correct forms out of alternative choices, joining clauses, rewriting sentences as directed, and replacing indicated sections with single words / opposites/synonyms, choosing to use correct punctuation marks, getting to understand and use formal and informal styles, learning to understand the usages of officialese, sexism,	10

	racism, jargon.. (ii) Learning to understand information structure of the sentence such as topic-focus relationship; strategies of thematization, postponement, emphasis, structural compression (deletion of redundant parts, nominalization, cleft and pseudo-cleft sentences, elliptical structures etc.), Logical Connectors between sentences, Methods of developing a paragraph, structure of an essay and methods of developing an essay	
Unit-4	**Exercises in Written Communication:** (i) Précis writing (ii) Note-taking skills (iii) Writing reports (iv) Guidelines and essentials of official correspondence for making enquiries, complaints and replies (v) Making representations; writing letters of application for jobs; writing CV, writing letters to the editor and social appeals in the form of letters/pamphlets.	10
	Total (Hours)	40

Text Books:

1. Communication Skills in English AICTE Prescribed Textbook (English) DIP122EN. By Anjan Tiwari. Publisher: Khanna Publishing; First Edition(1 January 2022)

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Students will review the grammatical forms of English and the use of these forms in specific communicative contexts, which include: class activities, homework assignments, reading of texts and writing.
CO2	Students will develop reading skills and reading speed. Students will read university texts and expand their vocabulary.
CO3	Students will develop reading skills and reading speed. Students will read university texts and expand their vocabulary.
CO4	Students will read for intensive information retrieval and interpretation required by university studies. Students will develop abilities as critical thinkers, readers and writer.
CO5	Students will attain and enhance competence in the four modes of literacy: writing, speaking, reading & listening. Students will write 3 summaries in which they will communicate appropriately, accurately and effectively what has been read.

Program Outcomes Relevant to the Course:

PO1	**Knowledge Adaption:** Ability to apply knowledge of computing appropriate to the discipline.
PO2	**Problem Analysis:** Ability to analyze a problem and identify and define the computing requirements appropriate to its solution.
PO3	**Design and Development:** Design system processes (components) that cater the exact needs of complex IT problems with background knowledge and intelligence on the need of hour
PO4	**Team Work** : Ability to function effectively on teams to accomplish a common goal.
PO5	**Ethics and Social Responsibilities:** Understanding of professional, ethical, legal, security and social issues and responsibilities.
PO6	**Effective Communication:** Ability to communicate effectively with a range of audience

PO7	**Computing Analysis Skill:** Ability to analyze the local and global impact of computing on individuals, organizations and society.
PO8	**Professional Ethics:** Recognition of the need for ability to engage in continuing professional development
PO9	**To keep abreast of technology:** Ability to use current techniques, skills and tools necessary for computing techniques.
PO10	**Coding Competency from Theory/Algorithms:** Ability to apply algorithmic principles and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
PO11	**Complexity Analysis:** Ability to apply design and development principles in the construction of software systems of varying complexity.

Type	**Code**	**LESSON PLAN**	**L-T-P**	**Credits**	**Marks**
Lecture No	Unit No	**COMMUNICATIVE ENGLISH**	3-1-0	4	80
Lecture01	1	**Topic:** What is communication **Ref:** https://www.commonsensemedia.org/articles/what-is-communication OR1;OR2;OR3;OR4;OR5;			
Lecture 02	1	**Topic:** Types of communication **Ref:** https://www.valamis.com/hub/types-of-communication OR1;OR2;OR3;OR4;OR5;			
Lecture 03	1	**Topic:** Horizontal, Vertical, Interpersonal, Grapevine **Ref:**https://study.com/academy/lesson/horizontal-communication-definition-advantages-disadvantages-examples.html OR1;OR2;OR3;OR4;OR5;			
Lecture04	1	**Topic:**Vertical **Ref:**https://harappa.education/harappa-diaries/what-is-vertical-communication/ OR1;OR2;OR3;OR4;OR5;			
Lecture 05	1	**Topic:** Interpersonal **Ref:** https://www.simplilearn.com/what-is-interpersonal-communication-article OR1;OR2;OR3;OR4;OR5;			
Lecture 06	1	**Topic:** Grapevine **Ref:** https://www.iedunote.com/grapevine OR1;OR2;OR3;OR4;OR5;			
Lecture 07	1	**Topic:** Uses of Communication **Ref:**https://law.dypvp.edu.in/blogs/importance-of-communication-and-its-process OR1;OR2;OR3;OR4;OR5;			
Lecture 08	1	**Topic:** Inter-cultural communication, Communication today **Ref:** https://ehlion.com/magazine/intercultural-communication/ OR1;OR2;OR3;OR4;OR5;			
Lecture 09	1	**Topic:** Distinct features of Indianisation, alternative texts of language learning, **Ref:** http://ignited.in/I/a/305136 OR1;OR2;OR3;OR4;OR5;			
Lecture 10	1	Topic: global English and English in the print and electronic media in India **Ref:** https://ukdiss.com/examples/esl-learners-print-electronic-media.php OR2;OR3;OR4;OR5;			

Lecture 11	2	**Topic:** The Four Skills and Prospect of new material in language learning **Ref:** https://preply.com/en/blog/the-main-4-skills-to-learn-a-language/ OR1;OR2;OR3;OR4;OR5;
Lecture 12	2	**Topic:** Listening-Passive and active **Ref:**https://www.indeed.com/career-advice/career-development/passive-vs-active-listening OR1;OR2;OR3;OR4;OR5;
Lecture 13	2	**Topic:** Speaking effective **Ref:**https://www.xsoftskills.com/2020/03/how-to-develop-effective-speaking-skills.html OR1;OR2;OR3;OR4;OR5;
Lecture 14	2	**Topic:** intelligibility and clarity **Ref:** https://en.wikipedia.org/wiki/Intelligibility_(communication) OR1;OR2;OR3;OR4;OR5;
Lecture 15	2	**Topic:** Methods and techniques of reading such as skimming **Ref:**https://www.angliaeducation.org/practical-reading-techniques-skimming-and-scanning/ OR1;OR2;OR3;OR4;OR5;
Lecture 16	2	**Topic:** scanning and searching for information, Reading to understand the literal **Ref:**https://www.utc.edu/enrollment-management-and-student-affairs/center-for-academic-support-and-advisement/tips-for-academic-success/skimming OR1;OR2;OR3;OR4;OR5;
Lecture 17	2	**Topic:** Identifying the tone (admiring, accusatory, ironical, sympathetic) **Ref:**https://www.utc.edu/enrollment-management-and-student-affairs/center-for-academic-support-and-advisement/tips-for-academic-success/skimming OR1;OR2;OR3;OR4;OR5;
Lecture 18	2	**Topic:** Identifying the tone (evasive, indecisive, ambiguous, neutral etc.) of the writer and view-points **Ref:** https://bodheeprep.com/tones-rc-passages-cat-exam OR1;OR2;OR3;OR4;OR5;
Lecture 19	2	**Topic:** Cohesive writing **Ref:** https://www.eapfoundation.com/writing/cohesion/ OR1;OR2;OR3;OR4;OR5;
Lecture 20	2	**Topic:** Coherent writing **Ref:**https://study.com/academy/lesson/coherence-in-writing-definition-examples.html OR1;OR2;OR3;OR4;OR5;
Lecture 21	3	**Topic:** Grammatical and Composition Skills: Doing exercises like filling in the blanks, correcting errors **Ref:** https://www.first-learn.com/english-grammar-and-composition.html OR1;OR2;OR3;OR4;OR5;
Lecture 22	3	**Topic:** choosing correct forms out of alternative choices, joining clauses **Ref:** https://www.first-learn.com/english-grammar-and-composition.html OR1;OR2;OR3;OR4;OR5;
Lecture 23	3	**Topic:** rewriting sentences as directed, and replacing indicated sections with single words / opposites/synonyms **Ref:** https://www.englishgrammar.org/rewrite-directed-3/

		OR1;OR2;OR3;OR4;OR5;
Lecture 24	3	**Topic:** choosing to use correct punctuation marks, getting to understand and use formal and informal styles **Ref:** https://www.englishgrammar.org/rewrite-directed-3/ OR1;OR2;OR3;OR4;OR5;
Lecture 25	3	**Topic:** learning to understand the usages of officialese, sexism, racism, jargon **Ref:** https://en.wikipedia.org/wiki/Officialese OR1;OR2;OR3;OR4;OR5;
Lecture 26	3	**Topic:** Learning to understand information structure of the sentence such as topic-focus relationship; strategies of thematization **Ref:** https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/ OR1;OR2;OR3;OR4;OR5;
Lecture 27	3	**Topic:** postponement, emphasis **Ref:** https://www.collinsdictionary.com/dictionary/english/postponement OR1;OR2;OR3;OR4;OR5;
Lecture 28	3	**Topic:** structural compression (deletion of redundant parts, nominalization, cleft and pseudo-cleft sentences, elliptical structures etc.) **Ref:** https://www.collinsdictionary.com/dictionary/english/postponement OR1;OR2;OR3;OR4;OR5;
Lecture 29	3	**Topic:** Logical Connectors between sentences, Methods of developing a paragraph **Ref:** https://staff.washington.edu/marynell/grammar/logicalconnectors.html OR1;OR2;OR3;OR4;OR5;
Lecture 30	3	**Topic:** structure of an essay and methods of developing an essay **Ref:**https://www.grammarly.com/blog/essay-structure/?gclid=EAIaIQobChMI_c3YrPiM_AIVRg4rCh3-ygBCEAAYASAAEgLVYPD_BwE&gclsrc=aw.ds OR1;OR2;OR3;OR4;OR5;
Lecture 31	4	**Topic:** Exercises in Written Communication: Précis writing Ref: https://leverageedu.com/blog/precis-writing OR1;OR2;OR3;OR4;OR5;
Lecture 32	4	**Topic:** Précis writing **Ref:** https://leverageedu.com/blog/precis-writing/ OR1;OR2;OR3;OR4;OR5;
Lecture 33	4	**Topic:** Note-taking skills **Ref:** https://www.student.unsw.edu.au/notetaking-tips OR1;OR2;OR3;OR4;OR5;
Lecture 34	4	**Topic:** Note-taking skills **Ref:** https://www.student.unsw.edu.au/notetaking-tips OR1;OR2;OR3;OR4;OR5;
Lecture 35	4	**Topic:** Writing reports **Ref:** https://www.grammarly.com/blog/how-to-write-a-report/ OR1;OR2;OR3;OR4;OR5;
Lecture 36	4	**Topic:** Writing reports **Ref:** https://www.grammarly.com/blog/how-to-write-a-report/ OR1;OR2;OR3;OR4;OR5;

Lecture 37	4	**Topic:** Guidelines and essentials of official correspondence for making enquiries, complaints and replies **Ref:**https://in.indeed.com/career-advice/career-development/how-to-write-a-letter-of-inquiry OR1;OR2;OR3;OR4;OR5;
Lecture 38	4	**Topic:**Guidelines and essentials of official correspondence for making enquiries, complaints and replies **Ref:**https://in.indeed.com/career-advice/career-development/how-to-write-a-letter-of-inquiry OR1;OR2;OR3;OR4;OR5;
Lecture 39	4	**Topic:** Making representations; writing letters of application for jobs; writing CV **Ref:**https://dictionary.cambridge.org/dictionary/english/make-representations-a-representation-to OR1;OR2;OR3;OR4;OR5;
Lecture 40	4	**Topic:** writing letters to the editor and social appeals in the form of letters/pamphlets **Ref:** https://www.toppr.com/guides/english/letter-writing/letter-to-editor-format/ OR1;OR2;OR3;OR4;OR5;

Type	Code	PROGRAMMING USING C++	L-T-P	Credits	Marks
CS	CC-3		3-1-2	4	100
Topic Objective	• To know about the Object Oriented Programming concepts. • To learn basics of C++ programming language. • To be able to develop logics to create programs/ applications in C++.				
Prerequisites	Basic analytical, logical, problem solving skills with basic knowledge and usage of computers is required for this course.				
Lecture Scheme	Regular lectures (classroom/virtual class with computer/Smartphone) with use of ICT as and when required, lectures are planned to be interactive with focus on application.				

Evaluation Scheme

Internal Assessment			Written Assessment	Total
Assignment(s)	Unit Test	Mid-Term (Written)	End-Term	
0	0	15	60	75

University Syllabus

Unit No	Topics	Hours
Unit-1	Principles of Object-Oriented Programming: Object-Oriented Programming (OOP) Paradigm, Basic Concepts of OOP, Benefits of OOP, Characteristics of OOPS, Object Oriented Languages, Applications of OOP. Introduction to C++, Difference between C & C++, Tokens, Data types, Operators, Structure of C++ Program, C++ statements, Expressions and Control Structures. Functions in C++: Argument passing in function, Inline Functions, Default Arguments, Const. Arguments, Friend function.	10
Unit-2	Classes and Objects: Defining Member Functions, Making an outside Function Inline, Nested Member Functions, Private Member Functions, Arrays within a Class, Memory Allocation for Objects, Static Data Members, Static Member Functions, Arrays of Objects, Objects as Function Arguments, Friend Functions. Constructors & Destructors: Constructors Parameterized Constructors, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructors, Destructors .	10
Unit-3	Inheritance: Basics of Inheritance, Type of Inheritance, Virtual Base Classes, Abstract Classes, Member Classes, Nesting of Classes. Polymorphism: Pointers, Pointers to Objects, this Pointer, Pointers to Derived Classes, Virtual Functions, Pure Virtual Functions, Function Overloading, Operator Overloading.	10
Unit-4	Managing Console I/O Operations: C++ Streams, C++ Stream Classes, Unformatted I/O Operations, Formatted Console I/O Operations, Managing Output with Manipulators. Files: Classes for File Stream Operations, Opening and Closing a File, Detecting end-of-file, File Modes, File Pointers and their Manipulations, Sequential Input and Output Operations, Updating a File: Random Access, Error Handling during File Operations, Command-line Arguments.	10
	Total (Hours)	40

Text Books

1. E. Balgurusawmy, Object Oriented Programming with C++, 4/e (TMH).
2. Paul Deitel, Harvey Deitel, "C++: How to Program", 9/e. Prentice Hall. Online Resources:

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Understand OOP concept, characteristics and applications of OOP and fundamentals of C++.
CO2	Apply the OOP concept to write C++ program in proper program structure.
CO3	Apply inheritance concept to reuse code in C++ program and use of pointers in writing polymorphism programs.
CO4	Analyze the Basics of files to write C++ program and know Error handling during file operation.

Program Outcomes Relevant to the Course:

PO1	**Computing Knowledge**: Apply the knowledge of mathematics, science, logic, computing fundamentals to address complex problems.
PO2	**Problem Analysis:** Ability in identifying, formulating and analyzing problems to derive substantiated conclusions through the applications of complex solutions.
PO3	**Design and Development**: Create solutions and system processes tailored to address complex IT challenges, leveraging both background knowledge and relevant tools.
PO4	**Investigation Techniques**: Employ computing knowledge and methodologies, such as experimental design, data analysis, interpretation and information synthesis to draw valid conclusions.
PO5	**Utilization of Modern Technology/Tools**: Skillfully create, select and apply appropriate techniques, resources and computing tools while understanding their limitations.
PO6	**Individual and Team Work:** Proficient in both independent and collaborative work across diverse environments, including leadership roles.
PO7	**Technocrat and Society:** Utilize contextual knowledge to assess societal, legal and security issues relevant to professional practices.
PO8	**Effective Communication**: Proficient in conveying complex ideas, writing reports, creating presentations and delivering messages to diverse audience.
PO9	**Ethics**: Adhere to ethical principles and professional norms for conducting oneself in a professional context.
PO10	**Skill and Competency**: Demonstrate the ability to analyze and apply the local and global impacts of project management, while consistently upgrading skill sets and navigating design various trade-offs.
PO11	**Lifelong Learning**: Recognize the necessity and possess the readiness and capability to engage in independent and continuous learning within the evolving landscape of technology.

Mapping of COs to POs: (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2		3					3	
CO2	3	3	2		3					3	
CO3	3	3	2		3					3	
CO4	3	3	2		3					3	

Type	Code	LESSON PLAN PROGRAMMING USING C++	L-T-P	Credits	Marks
Lecture No	Unit No		3-1-2	4	75
Lecture 1	1	**Topic:** Introduction to Object Oriented Programming, A comparison of recent C++ Languages used in industry/research. **Ref:** TB1 (1.1, 1.2); OR1			
Lecture 2	1	**Topic:** Programming Paradigms and limitation of structural language, Introduction to OOP and its advantages. **Ref:** TB1 (1.3, 1.6); OR2			
Lecture 3	1	**Topic:** Basic Characteristics of OOPS, Different Object Oriented Languages, Applications of OOP in real life and industry. **Ref:** TB1 (1.7, 1.8); OR1			
Lecture 4	1	**Topic:** A comparison between C & C++, Different Tokens used in C++, Basic Data types. **Ref:** TB1 (2,1, 3.2,3.5,3.6,3.7); OR1			
Lecture 5	1	**Topic:**, Operators used in C++. **Ref:** TB1 (3.13-3.18); OR3			
Lecture 6	1	**Topic:**, Basic Structure of C++ Program, C++ statements **Ref:** TB1 (2.3,2.4,2.6); OR4			
Lecture 7	1	**Topic:**, Expressions and their types, Control Structures used in C++ program. **Ref:** TB1 (3.19,3.20,3.24); OR5			
Lecture 8	1	**Topic:**, Argument passing in function, use of pass by reference in C++. **Ref:** TB1 (4.2,4.3,4.4,4.5); OR1			
Lecture 9	1	**Topic:** Inline function. Default, Arguments, Const. Arguments **Ref:** TB1 (4.6,4.7,4.8); OR1			
Lecture 10	1	**Topic:** Function overloading, Friend and virtual function. **Ref:** TB1 (4.9,4.10); OR2			
Lecture 11	2	**Topic:** Basic concept of class, Defining Member Functions inside and outside class. **Ref:** TB1 (5.3,5.4,5.5,5.6); OR2			
Lecture 12	2	**Topic:** Nesting of Member Functions, Private Member Functions. **Ref:** TB1 (5.7,5.8); OR1			
Lecture 13	2	**Topic:** Arrays within a Class, Memory Allocation for Objects. **Ref:** TB1 (5.9,5.10); OR1			
Lecture 14	2	**Topic:** Static Data Members, Static Member Functions. **Ref:** TB1 (5.11,5.12); OR1			
Lecture 15	2	**Topic:** Arrays of Objects, Objects as Function Arguments. **Ref:** TB1 (5.13,5.14); OR3			
Lecture 16	2	**Topic:** Friend Functions, Introduction to Constructors, Application of constructor. **Ref:** TB1 (5.15,6.1,6.2); OR4			
Lecture 17	2	**Topic:** Types of Constructor Parameterized Constructors, Constructors with Default Arguments. **Ref:** TB1 (6.3,6.5); OR1			
Lecture 18	2	**Topic:** Dynamic Initialization of Objects, Copy Constructor. **Ref:** TB1 (6.6,6.7); OR1			

Lecture 19	2	**Topic:** Dynamic Constructor. Use of different types of constructor with examples
Lecture 20	2	**Topic:** Concept of Destructor, Difference between constructor and destructor. **Ref:** TB1 (6.11); OR1
Lecture 21	3	**Topic:** Introduction to Inheritance, Advantages of inheritance, Making private member inheritable. **Ref:** TB1 (8.2,8.3,8.4); OR2
Lecture 22	3	**Topic:** Different Types of Inheritance, Concept of Virtual Base class **Ref:** TB1 (8.5-8.9); OR3
Lecture 23	3	**Topic:** Abstract Classes, Member Classes: Nesting member class. **Ref:** TB1 (8.10-8.12); OR3
Lecture 24	3	**Topic:** Basic concept of Polymorphism, Types of polymorphism, Dynamic binding, static binding. **Ref:** TB1 (9.1); OR1
Lecture 25	3	**Topic:** Basic concept of Pointer, Pointers to Objects. **Ref:** TB1 (9.2,9.3); OR1
Lecture 26	3	**Topic:** this Pointer, Pointers to Derived Classes. **Ref:** TB1 (9.4,9.5); OR4
Lecture 27	3	**Topic:** Concept and rules of Virtual Functions. Working of Virtual function **Ref:** TB1 (9.6); OR5
Lecture 28	3	**Topic:** Concept of Pure Virtual Functions, relation between pure virtual function and abstract class. **Ref:** TB1 (9.7); OR1
Lecture 29	3	**Topic:** Concept of Function Overloading, Function overloading vs Function overriding. **Ref:** TB1 (4.9); OR1
Lecture 30	3	**Topic:** Concept of Operator Overloading. **Ref:** TB1 (3.22,7.1,7.2); OR1
Lecture 31	4	**Topic:** I/O Operations: Introduction to C++ Streams, C++ Stream Classes. **Ref:** TB1 (10.1,10.2,10.3); OR4
Lecture 32	4	**Topic:** Unformatted I/O Operations , Formatted Console I/O Operations. **Ref:** TB1 (10.4,10.5); OR3
Lecture 33	4	**Topic:** Managing Output with Manipulators. **Ref:** TB1 (10.6); OR5
Lecture 34	4	**Topic:** Working with files, Classes for File Stream Operations, Opening and Closing a File. **Ref:** TB1 (11.2,11.3); OR1
Lecture 35	4	**Topic:** Detecting end of-file, more about File Modes. **Ref:** TB1 (11.4,11.5); OR2
Lecture 36	4	**Topic:** File Pointers and their Manipulations. **Ref:** TB1 (11.6); OR3
Lecture 37	4	**Topic:** Sequential Input and Output Operations. **Ref:** TB1 (11.7); OR4
Lecture 38	4	**Topic:** Concept of Updating a File: Random Access. **Ref:** TB1 (11.8); OR1
Lecture 39	4	**Topic:** Concept of Error Handling during File Operations,. **Ref:** TB1 (11.9); OR1
Lecture 40	4	**Topic:** Command-line Arguments, examples **Ref:** TB1 (11.10); OR1

BCA-2

SN	Code	Paper	Credit	No. of Classes	L-T-P	Marks MT-ET-PRTL-(T)	Faculty	Deadline
1	Core-4	Data Structure	4+2	40+20	3-1-2	15-60-25-(100)	Mr. C Sethi	

Type	Code	DataStructure	L-T-P	Credits	Marks
	CORE-4		3-1-2	4+2	100
Topic Objective		To learn how the choice of data structures impacts the performance of programs. To study specific data structures such as arrays, linear lists, stacks, queues, binary trees, binary search trees, heaps and AVL tree. To learn efficient searching and sorting techniques.			
Prerequisites		Problem solving ability, Basic knowledge in C/C++ programming language (Array, Function, Structure, and Pointer), Mathematics (Basic knowledge in Number Theory, Linear Algebra, Graph Theory)and basic knowledge in pseudocode.			
Lecture Scheme		Regular lectures (classroom/virtual class with Laptop/Desktop/Smartphone) with use of ICT,lectures areplanned to be interactive with focus on problem solving activities.			

Evaluation Scheme

Mid-Term (Written)	End-Term	Practical	Total
15	60	25	100

University Syllabus

Unit No	Topics	Hours
Unit-1	**Introduction:** Basic Terminology, Data structure, Time and space complexity, Review of Array, Structures, Pointers. **Linked Lists:** Dynamic memory allocation, representation, Linked list insertion anddeletion, Searching, Traversing in a list, Doubly linked list, Sparse matrices.	**10**
Unit-2	**Stack:** Definition, Representation, Stack operations, Applications (Infix–Prefix–Postfix Conversion& Evaluation, Recursion). **Queues:** Definition, Representation, Types of queue, Queue operations, Applications.	**10**
Unit-3	**Trees:** Tree Terminologies, General Tree, Binary Tree, Representations, Traversing, BST, Operations on BST, Heap tree, AVL Search Trees, M-way search tree, Applications of all trees.	**10**
Unit-4	**Sorting:** Exchange sorts, Selection Sort, Bubble sort, Insertion Sorts, Merge Sort, Quick Sort, Radix Sort, Heap sort. **Searching:** Linear search, Binary search.	**10**
	Total (Hours)	**40**

Text book:

TB:D. Samanta , “Classic Data Structure,” PHI , 2/ed.

Reference Books:

RB1:*Ellis Horowitz*,SartajSahni, “Fundamentals of Data Structures,”Galgotia Publications, 2000.

RB2:*Sastry C. V., Nayak R, Ch, Rajaramesh*, “Data Structure and Algorithms,” I. K. International Publishing House Pvt. Ltd., New Delhi.

Online Resources:
OR1:https//nptel.ac.in/courses/
OR2: https://www.educba.com/data-vs-information/
OR3:https://afteracademy.com/blog/time-and-space-compexity-analysis-of-algorithm
OR4: https://www.udemy.com/topic/data-structures/free/
OR5:https://www.geeksforgeeks.org/data-structures/

Type	Code	LESSON PLAN	L-T-P	Credits	Marks
Lecture No	Unit No	**Data Structures**	3-1-2	4+2	100
Lecture01	1	**Topic:** Introduction to Data Structure, What is Data? What is Information? Difference between Data and Information, Basic Terminology: Data, Information, Data Type, Abstract Data Type (ADT). **Ref:**TB (1.1, 1.2,1.3,pg1-6); OR1;OR2;OR3;OR4;OR5;			
Lecture 02	1	**Topic:**Classification of Data Structure: Linear Data Structure & Non-linear Data Structure; Definition of Algorithms, Flowchart of Algorithms, What do you mean by a good algorithm, Time and space complexity: Best Case, Worst Case Average Case, Ω notation, Θ notation, O notation. **Ref:**TB (1.1-1.3,A.1-A.16, pg6-7& pg761-771); OR1;OR2;OR3;OR4;OR5;			
Lecture 03	1	**Topic:**Review of Array: Definition, Terminology, Types of Array, Memory Representation of 1-D Array; Operations on Array: Traversing, Sorting, Searching, Insertion, Deletion, Merging; Multidimensional Arrays: Memory Representation of 2-D; Applications of Array. **Ref:**TB (2.1-2.4,pg12-24); OR1;OR2;OR3;OR4;OR5;			
Lecture 04	1	**Topic:**Structures: Defining a Structure, Declaring Structure Variable, Accessing Structure Members, Structure Initialization, Arrays of Structures, Arrays within Structures, and Structures within Structures. **Ref:**OR1;OR2;OR3;OR4;OR5;			
Lecture0 5	1	**Topic:**Pointers: Definition, Understanding Pointers, Accessing Address of a Variable, Declaring Pointer Variable, Initialization of Pointer Variable, Accessing a Variable through its Pointer, Chain of Pointers, Pointers & Arrays. **Ref:**OR1;OR2;OR3;OR4;OR5;			
Lecture0 6	1	**Topic:**Dynamic memory allocation: Introduction, Malloc, Calloc, Free,Realloc;Linked Lists:Definition, Representation of Linked List in Memory (Static Representation & Dynamic Representation) **Ref:**TB (3.1-3.2, pg36-39);OR1;OR2;OR3;OR4;OR5;			
Lecture 07	1	**Topic:**Operations on a Single Linked List:Traversing, Insertion (insert at front, insert at end, and insert at any position), Deletion (delete at front, delete at end and delete at any position of a Single Linked List). **Ref:**TB (3.2,pg40-47); OR1;OR2;OR3;OR4;OR5;			
Lecture 08	1	**Topic:**Copying a single Linked List, Merging two Single Linked Lists, Searching an element in Single Linked List, Circular Linked List: Operations on Circular Linked List(Searching an element and Merging two Circular Linked Lists). **Ref:**TB (3.3,pg48-54); OR1;OR2;OR3;OR4;OR5;			
Lecture 09	1	**Topic:**Doubly Linked Lists: Understanding Double Linked Lists, Operations on Double Linked Lists (inserting a node at the front, inserting a node at the end, inserting a node at any position, delete at front, delete at end, delete at any position), Circular Double Linked Lists. **Ref:**TB (3.4-3.5,pg54-62); OR1;OR2;OR3;OR4;OR5;			
Lecture 10	1	**Topic:**Applications of Linked Lists: Sparse Matrix Manipulation, Polynomial Representation (polynomial having single variable and polynomial having multiple variable), Dynamic Storage Management. **Ref:**TB (3.6,pg63-73); OR1;OR2;OR3;OR4;OR5;			

Lecture 11	2	**Topic:**Stack:Definition of Stacks, Representation of a Stacks (Array Representation of Stacks and Linked List Representation of Stacks), Stack Operations (PUSH, POP, STATUS of Array and Linked List Representations). **Ref:**TB (4.1-4.4,pg105-110); OR1;OR2;OR3;OR4;OR5;
Lecture 12	2	**Topic:**Applications of Stacks:Evaluation of Arithmetic Expressions (Notations for arithmetic expressions: Infix Notation, Prefix Notation, and Postfix Notation). **Ref:**TB (4.5.1,pg111-114); OR1;OR2;OR3;OR4;OR5;
Lecture 13	2	**Topic:**Conversion of an Infix Expression into Postfix Expression, Evaluation of a Postfix Expression. **Ref:**TB (4.5,pg115-118); OR1;OR2;OR3;OR4;OR5;
Lecture 14	2	**Topic:**Conversion of a Postfix Expression into a Code, Code Generation for Stack Machines. **Ref:**TB (4.5.1,4.5.2,pg119-123); OR1;OR2;OR3;OR4;OR5;
Lecture 15	2	**Topic:**Implementation of Recursion: Factorial Calculation. **Ref:**TB (4.5.3,pg123-127); OR1;OR2;OR3;OR4;OR5;
Lecture 16	2	**Topic:**Queues:Introduction,Definition of Queue, Representation of Queue (Using Arrays and Using Linked List), Operations on Array Representation (Enqueue, Dequeue). **Ref:**TB (5.1-5.3.1,pg153-159); OR1;OR2;OR3;OR4;OR5;
Lecture 17	2	**Topic:**Queue operations on Linked List Representation (Enqueue, Dequeue, And Status of the Queue), Circular Queue: Array Representation of Circular Queue, Logical and Physical Views, Operations (Enqueue, Dequeue). **Ref:**TB (5.3.2-5.4.1,pg159-164); OR1;OR2;OR3;OR4;OR5;
Lecture 18	2	**Topic:**Deque: Introduction, Definition, Operations (Push, Pop, Inject, Eject). **Ref:**TB (5.4.2,pg164-166); OR1;OR2;OR3;OR4;OR5;
Lecture 19	2	**Topic:**Priority Queue: Introduction, Definition, Priority queue using an Array, Multi-queue Implementation, and Linked List Representation of a Priority Queue. **Ref:**TB (5.4.3,pg167-172); OR1;OR2;OR3;OR4;OR5;
Lecture 20	2	**Topic:**Applications of Queue: Simulation, CPU Scheduling in a Multiprogramming Environment. **Ref:**TB (5.5.1-5.5.2,pg172-186); OR1;OR2;OR3;OR4;OR5;
Lecture 21	3	**Topic:**Trees:Introduction, Basic Terminologies, Definition and Concepts of General Tree. **Ref:**TB (7.1-7.2,pg212-216); OR1;OR2;OR3;OR4;OR5;
Lecture 22	3	**Topic:**Binary Trees: Definition of Binary Tree, Full Binary Tree, Complete Binary Tree, Properties of a Binary Tree, Representations (Linear Representation, Advantages and Disadvantages of Linear/Sequential Representation, Linked Representation) Operations on Binary Trees. **Ref:**TB (7.2.1-7.4.2,pg217-237); OR1;OR2;OR3;OR4;OR5;
Lecture 23	3	**Topic:**Traversals: Inorder Traversal, Preorder Traversal, Postorder Traversal, Non-recursive Implementation of Traversal algorithms, **Ref:**TB (7.4.3,pg237-243); OR1;OR2;OR3;OR4;OR5;
Lecture 24	3	**Topic:**Formation of Binary Tree from its Traversals (Formation from Inorder& Preorder, Inorder&Postorder, and Preorder &Postorder), Merging Together Two Binary Trees. **Ref:**TB (7.4.3-7.4.4,pg243-249); OR1;OR2;OR3;OR4;OR5;
Lecture 25	3	**Topic:**Binary Search Tree: Definition of Binary Search Tree, Operations on BST (Searching a BST, Inserting a Node into a BST, Deleting a Node from a BST), Traversals on BST, And Applications of BST. **Ref:**TB (7.5.2,pg254-265); OR1;OR2;OR3;OR4;OR5;
Lecture 26	3	**Topic:**Heap trees: Definition, Representation of a Heap Tree, Operations on a Heap Tree (Insert a Node into a Heap Tree, Delete a Node from a Heap Tree, Merging Two Heap Trees, and Applications of Heap Trees. **Ref:**TB (7.5.3,pg266-275); OR1;OR2;OR3;OR4;OR5;
Lecture 27	3	**Topic:**Height Balanced Binary Tree: Definition, AVL Rotations (Case1, Case2, Case3, Case4). **Ref:**TB (7.5.5,pg289-298); OR1;OR2;OR3;OR4;OR5;
Lecture 28	3	**Topic:**Implementation for Height Balancing a Tree, Height of a Height Balanced Binary Tree. **Ref:**TB (7.5.5,pg299-306); OR1;OR2;OR3;OR4;OR5;

Lecture 29	3	**Topic:**M-way search tree: Definition, B Trees, B Tree Indexing, Operations on B Tree(Searching, Inserting, Deleting) Lower and Upper Bound of a B Tree. **Ref:**TB (7.7-7.7.3,pg375-401); OR1;OR2;OR3;OR4;OR5;
Lecture 30	3	**Topic:**B+ Tree Indexing: Definition, Operations on B+ Tree Indexing (Searching, Insertion, Deletion), B Tree vs. B+ Tree. **Ref:**TB (7.8,pg401-403); OR1;OR2;OR3;OR4;OR5;
Lecture 31	4	**Topic:**Sorting:Introduction, Basic Terminologies, Sorting Techniques (Sorting by Comparison and Sorting by Distribution). **Ref:**TB (10.1-10.2,pg528-532); OR1;OR2;OR3;OR4;OR5;
Lecture 32	4	**Topic:**Sorting by Insertion: Straight Insertion Sorts, List Insertion Sort, Binary Insertion Sort, and Two-Way Insertion Sort. **Ref:**TB (10.1-10.2,pg532-553); OR1;OR2;OR3;OR4;OR5;
Lecture 33	4	**Topic:**Sorting by Selection: Straight Selection Sort, Tree Selection Sort. **Ref:**TB (10.4-10.4.2,pg554-572); OR1;OR2;OR3;OR4;OR5;
Lecture 34	4	**Topic:**Heap sort: Introduction, Heap Tree (Max Heap, Min Heap), Sorting using Heap Tree, Create Heap, Remove Max, and Rebuild Heap. **Ref:**TB (10.4.3,pg573-591); OR1;OR2;OR3;OR4;OR5;
Lecture 35	4	**Topic:**Sorting by Exchange: Introduction, Bubble sort (Concept and Example) **Ref:**TB (10.5.1,pg593-599); OR1;OR2;OR3;OR4;OR5;
Lecture 36	4	**Topic:**Quick Sort: Introduction, Divide-and-Conquer, Divide-and-Conquer Approach in Quick Sort, Partition Method in Quick Sort. **Ref:**TB (10.5.4,pg612-629); OR1;OR2;OR3;OR4;OR5;
Lecture 37	4	**Topic:**Sorting by Distribution: Introduction, Radix Sort. **Ref:**TB (10.6-10.6.1,pg636-642); OR1;OR2;OR3;OR4;OR5;
Lecture 38	4	**Topic:**Sorting by Merging: Simple Merging, Binary Merge, Merge Sort (Internal Merge Sort and External Merge Sort). **Ref:**TB (10.7-10.7.7,pg658-687); OR1;OR2;OR3;OR4;OR5;
Lecture 39	4	**Topic:**Searching:Introduction, Basic Terminologies, Linear search Techniques (Sequential Search with Arrays, Sequential Search with Linked List. **Ref:**TB (11.1-11.2.2,pg712-720); OR1;OR2;OR3;OR4;OR5;
Lecture 40	4	**Topic:**Non-linear Search Techniques: Introduction, Binary Tree Searching, BST Searching. **Ref:**TB (11.3-11.3.2,pg738-751); OR1;OR2;OR3;OR4;OR5;

LESSON PLAN

BS	GE/IC-2	(Statistics)	L-T-P	Credits	Marks
Lecture No	Unit No		3-1-0	4	75
Lecture 1	1	Topic: Definition scope of statistics, limitations and use **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-1			
Lecture 2	1	Definition of population and samples in statistics, Examples of population and samples **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-1			
Lecture 3	1	Types of data: Qualitative and quantitative, Examples based on qualitative and quantitative data. **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-1			
Lecture 4	1	Definition of attributes and variables **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-1			
Lecture 5	1	Measurement scale: nominal, ordinal, interval, ratio, Definition &examples of scales **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics)			
Lecture 6	1	Representing a data set by tabular method, make a frequency distribution **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-2			
Lecture 7	1	Frequency distribution of grouped and individual data **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-2			
Lecture 8	1	Graphical representation of data, Definitions and types of graphs **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-2			
Lecture 9	1	Frequency curve, ogive curve, cf curve **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-2			
Lecture 10	1	Histogram representation, Histogram of grouped frequency distribution **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-2			
Lecture 11	2	Measures of Central tendency, Different types of averages **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-2			
Lecture 12	2	Definition of mathematical and positional averages **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-2			
Lecture 13	2	Mathematical average: arithmetic mean, geometric mean, harmonic mean, Definition and numerical examples. **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-2			
Lecture 14	2	Positional average, median, mode, Definition and numerical examples **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-2			
Lecture 15	2	Measures of dispersion, Definition and types **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-3			
Lecture 16	2	Standard deviations, mean deviations, range, quartile deviations **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-3			
Lecture 17	2	Moments, absolute and relative moments, Relationship between moments **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-3			
Lecture 18	2	Deviations of Central moments and raw moments, Relationship between them **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-3			
Lecture 19	2	Measures of skewness, Calculation of skewness and skewed curve. **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-3			
Lecture 20	2	Measures of kurtosis, calculation of kurtosis **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-3			

Lecture 21	3	Definition of correlation, simple linear correlation **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-10
Lecture 22	3	Scattered diagram **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-10
Lecture 23	3	Calculation of karl Pearsons correlation coefficient **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-10
Lecture 24	3	Calculation of partial correlation **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-10
Lecture 25	3	Definition of multiple correlation and calculation of multiple correlation coefficient **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-10
Lecture 26	3	Calculation of rank correlation coefficient, spearmans rank correlation coefficient, rank correlation with tied rank. **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-10
Lecture 27	3	Numerical problems based on correlation, rank correlation, multiple correlation **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-10
Lecture 28	3	Definition of regression analysis, lines of regression **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-10
Lecture 29	3	Calculation of regression coefficient **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-10
Lecture 30	3	Problems based on regression lines **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-10
Lecture 31	4	Principle of least square method for fitting curves, Derivation of normal eqn **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-9
Lecture 32	4	Fitting a straight line y=a+bx by using least square method **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-9
Lecture 33	4	Fitting a parabola and polynomial curve by least square method **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-9
Lecture 34	4	Exponential curve fitting by principle of least square method **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-9
Lecture 35	4	Theory of attributes, Definition of positive and negative attributes **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-11
Lecture 36	4	Class and class frequency of attributes, preparing FT of 2×2 attributes **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-11
Lecture 37	4	Independence and association of attributes **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-11
Lecture 38	4	Consistency of data, example on consistency of data. **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-11
Lecture 39	4	Measures of association and contingency **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-11
Lecture 40	4	Yules coefficient of colligation, numerical based on yules coefficient. **Ref:** TB1 (Gupta and kapoor-Fundamental of statistics) chapter-11