Course Name: Data Structures and File Organization **Subject Code:** TBI 201

Program Name: BSc IT

1 Contact Hours: 48 **L** 3 **T** 0 **P** 0

2 Examination Duration (Hrs): **Theory** 0 3 **Practical** 0 0

3 Relative Weightage: **CWE:** 25 **MTE:** 25 **ETE:** 50

4 Credits: 0 3

5 Semester: ☐ **Autumn** ☑ **Spring** ☐ **Both**

6 Pre-Requisite: **Knowledge of C language**

7 Subject Area: **Computer Applications**

8 Objective: To familiarize students with the Data Structures

9 Course Outcomes: A student who successfully fulfills the course requirements will be able to:

a) Have a comprehensive knowledge of the data structures
b) Understand algorithms on which file structures and data bases are based
c) Understand the importance of data
d) Identify the data requirements for an application
e) Understand the practical experience of algorithmic design and implementation.
f) Implement different data structures.

10 Details of the Course:

Unit No.	CONTENT	CONTACT HOURS
1	**Algorithm Basics:** Basic Terminology, types and characteristics, Algorithm Complexity and Time-Space trade-off. **Introduction to Data Structure:** Elementary Data Organization, Data Structure operations, Pointers Review; Static and Dynamic Memory Allocation; **Arrays**: Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character, Array as Parameters, Ordered list, Sparse Matrices, and Vector.	10
2	**Stacks**: Array Representation and Implementation of stack, Operations and Stacks: Push and POP, Array Representation of Stack, Linked	10

	Representation of stack, Operations Associated with Stacks, Application of stack, Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. **Queues**: Array and linked representation and implementation of queues, Operations on Queue; Create, Add, Delete, Full and Empty, Circular queue, Dequeue, and Priority Queue.	
3	**Link List (s):** Representation and implementation of Singly linked lists, Header Linked List, Insertion and deletion to from Linked Lists Traversing and Searching of Linked List, Overflow and Underflow, , Insertion and deletion Algorithms, Doubly linked list, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.	10
4	**Searching** : Linear and Binary searching **Sorting**: Bubble sort technique, Selection sort technique, Insertion sort technique, Merge sort technique, Quick sort technique. **Recursion**: definition, types of recursion, call stack, iteration – recursion difference.	8
5	**Trees**: Basic Terminology, Types; **Binary Trees :** Binary Tree, Binary Tree Representation Algebraic Expressions, Complete Binary Tree, Extended Binary Tree, Array And Linked Representation Of Binary Trees, Traversing Binary Trees; **Binary Search Trees:** Insertion, Traversing, Search, Deletion Operations; Threaded Binary Tree, AVL Tree **Huffman Tree:** Huffman Tree And Codes; **Multiway Search Tree:** B –Trees, B^+ Tree; **File Organizations**: Introduction To File System, Sequential File Organization, Index Sequential Organization, Relative File Organization, Multi-Key File Organization.	10
	TOTAL	**48**

11 Suggested Books:

Sl. NO.	NAME OF AUTHERS/BOOKS/PUBLISHERS	YEAR OF PUBLICATION
1	Horowitz and Sahani, "Fundamentals of data Structures", Galgotia	2009
2	Lipschutz, "Data Structure", TMH	2008
3	R. Kruse etal, "Data Structures and Program Design in C", Person Education	2010
4	A.M. Tenenbaum etal, "Data Structures and Program Design in C", Person Education	2011
5	K Loudon, "Mastering Algorithms With C", Shroff Publishers and Distributors	2012

Course Name: Digital Electronics **Subject Code:** TBI 202

Program Name: BSc IT

1 Contact Hours: 45 **L** 3 **T** 0 **P** 0

2 Examination Duration(Hrs): **Theory** 0 3 **Practical** 0 0

3 Relative Weightage: **CWE:** 25 **MTE:** 25 **ETE:** 50

4 Credits: 0 3

5 Semester: ☐ **Autumn** ☑ **Spring** ☐ **Both**

6 Pre-Requisite: **Knowledge of computer fundamentals**

7 Subject Area: **Computer Application**

8 Objective: To familiarize students with the concepts of digital electronics and the working principles of combinational and sequential circuits

9 Course Outcomes: A student who successfully fulfills the course requirements will be able to:

CO 1: Illustrate the Binary, Octal, Hexadecimal number system, conversion, complements and various types of codes.

CO 2: Cognize and describe the various logic gates and simplification of the Boolean expressions using K map.

CO 3: Describe the design procedure of various combinational circuits.

CO 4: Analyze the design procedure of various sequential circuits and conversion process of flip flops.

CO 5: Differentiate between registers and counters and the functionality of counters.

CO 6: Review the basic working/design principles of combinational and sequential circuits and their usefulness and applications in real life.

10 Details of the Course:

Unit No.	CONTENT	CONTACT HOURS
1	**NUMBER SYSTEMS :** Data Representation**,** Binary number system, Octal & Hexa-decimal number system, Conversion between number system, Arithmetic operation on Binary numbers, r's and r-1's complement, Booth's multiplication algorithm, Overflow & underflow,	7

	Fixed and Floating Point Representation, Codes, ASCII, EBCDIC codes, Gray code, Excess-3 & BCD, Error detection & correcting codes.	
2	**LOGIC GATES** Logic Gates, AND, OR, NOT GATES and their Truth tables, NOR, NAND, XOR and XNOR gates, Universal Gates and their implementation. Boolean Algebra, Basic Boolean Law's, Demorgan's theorem, Minterms and Maxterms, K-MAP Simplification, Minimization techniques, Sum of Product & Product of Sum. Canonical forms.	10
3	**COMBINATIONAL CIRCUITS:** Design procedure – Adders-Subtractors – Serial adder/ Subtractor - Parallel adder/ Subtractor. Multiplexer/Demultiplexer, Encoder / Decoder. Implementation of combinational logic circuits.	10
4	**SEQUENTIAL CIRUITS:** Flip-flops- Types of flip-flops, SR, JK, T, D and Master slave – Characteristic table and equation. Realizations of one flip flop using other flip-flops. Definition of registers, types of registers. Basic shift registers, Applications of registers	8
5	**COUNTERS:** Definition of counters, types of counters, asynchronous counters, synchronous counters, Ring counters, up/down counters etc. Applications of counters.	10
	TOTAL	**45**

11 Text Books:

Sl. NO.	**NAME OF AUTHERS/BOOKS/PUBLISHERS**	**YEAR OF PUBLICATION/REPRINT**
1	M. Morris Mano, Digital Design, 5 ed., Pearson , New Delhi	2014
2	R.P.Jain, Modern Digital Electronics, 3 ed., Tata McGraw–Hill publishing company limited, New Delhi	2008
3	Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 5 ed., Tata McGraw Hill	2010
4	Thomas L. Floyd, Digital Fundamentals, Pearson Education, Inc, New Delhi, 2003	2011

Course Name: Object Oriented Programming Using C++ **Subject Code:** TBI 203

Program Name: BSc IT

1 Contact Hours: 48 **L** 3 **T** 0 **P** 0

2 Examination Duration (Hrs): **Theory** 0 3 **Practical** 0 0

3 Relative Weightage: **CWE:** 25 **MTE:** 25 **ETE:** 50

4 Credits: 0 3

5 Semester: ☑ **Autumn** ☐ **Spring** ☐ **Both**

6 Pre-Requisite: **Knowledge of C language**

7 Subject Area: **Programming**

8 Objective: **To familiarize students with the Object-Oriented Concepts and its implementation through the C ++ Language.**

9 Course Outcomes: A student who successfully fulfills the course requirements will be able:

CO1	To Describe the differences between procedure-oriented programming and object-oriented programming.
CO2	To implement basis concepts of the object-oriented programming language like encapsulation, abstraction, inheritance, polymorphism etc.
CO3	To understand basic concept of C++
CO4	To define the object-oriented approach by implementing various streams, classes, member functions and objects.
CO5	To apply inheritance at various levels incorporating virtual and pure virtual functions.
CO6	To analyse exception handling techniques and provide solutions to storage related problems using STL and implement the concepts of generic programming.

10 Details of the Course:

Unit No.	CONTENT	CONTACT HOURS
1	**Beginning with OOP:** Introduction of object-oriented programming (OOP) with real examples, Difference b/w POP and OOP. Basic concepts of OOP like polymorphism, inheritance, encapsulation, abstraction etc.	8

	Applications and benefits of OOPs. **Moving from C to C++:** Scope resolution operator with its uses, variable definition, Inline function, function overloading and overriding, default arguments, structure, runtime memory management.	
2	**Classes and Object:** Defining Classes and Objects in C++, Encapsulation, Member Functions, Instantiating using Classes. Constructors with its types, Destructors, Static data members, Friend functions, Friend class,passing objects as arguments, Returning objects, Arrays of objects, Dynamic objects, Pointers to objects, This Pointer **Initialization and Assignment:** Initialization vs. Assignment, The Copy Constructor, Assigning Values, Specialized Constructors and Methods,	8
3	**Operator overloading:** Operator overloading, Unary operator overloading, limitations of increment/decrement operators, binary operator overloading, overloading using friend functions, Data Conversion. **Inheritance**: Base Class and Parent Class, Inheritance and its types, Protected base class inheritance, Inheriting multiple base classes; Constructors, Destructors, Passing parameters to base class constructors, Access Specifiers, Virtual base classes.	10
4	**Virtual Functions:** Virtual function, calling a Virtual function through a base class reference, Pure virtual functions, Abstract classes, Using virtual functions, Early and late binding. **Generic Programming with template:** Function template, overloading function templates, class template, inheritance of class templates.	12
5	**I/O System Basics, File I/O:** C++ stream classes, Formatted I/O, I/O manipulators, fstream and the File classes, File operations **Exception Handling, STL:** Exception handling fundamentals, Exception handling options STL: An overview, containers, vectors, lists, maps.	10
	TOTAL	**48**

11 Suggested Books:

Sl. NO.	NAME OF AUTHERS/BOOKS/PUBLISHERS	YEAR OF PUBLICATION
1	E. Balagurusamy, Object oriented Programming with C++, 7/ed, TMH.	2017
2	Lippman. S. B. et al.,"C++ Primer" Fifth Edition, Addition Wesley.	2013
3	B. Stroustrup, The C++ Programming Language, Fourth edition, Addison-Wesley.	2013
4	P.M. Chirlian: Programming in C++ Merrill Pub. 1990.	2008
5	Deitel H. M. & Deitel P. J., "How to Program C+", Fifth Edition PHI.	2006

Course Name: Discrete Mathematical Structures **Subject Code:** TBI 204

Program Name: BSc IT

1 Contact Hours: 48 **L** 3 **T** 1 **P** 0

2 Examination Duration(Hrs): **Theory** 0 3 **Practical** 0 0

3 Relative Weightage: **CWE:** 25 **MTE:** 25 **ETE:** 50

4 Credits: 0 4

5 Semester: ☐ **Autumn** ☑ **Spring** ☐ **Both**

6 Pre-Requisite: Basic knowledge of logic gates and Graphs

7 Subject Area: Mathematics

8 Objective: To familiarize students with the working of the Graphs used in computer science

9 Course Outcome A student who successfully fulfills the course requirements will be able to:

a) Understand the theory and techniques of logic, graphs and trees, and algebraic systems
b) Apply the knowledge and skills obtained to investigate the problems
c) solve a variety of discrete mathematical problems.
d) Communicate mathematical ideas.
e) Make effective use of appropriate technology.

10 Details of the Course:

Unit No.	CONTENT	CONTACT HOURS
1	Matrices: Notation and Definition, Types of Matrices, Algebra of Matrices, Transopose of a Matrix, Solution of linear Equations by Matrix method, Rank of matrix, Eigen values and Eigen vectors, Cayley Hamilton theorem	10
2	Boolean algebra: Basic operations, Boolean functions, Boolean expression, De-Morgan's theorem, Logic gates, SOP and POS forms, Normal forms, Simplification of Boolean expression, Logic and switching networks, Karnaugh map method for simplification of Boolean expression	10
3	Graph theory: Definition and application of graphs, Konigsberg bridge problem, Simple graph, multi graph and pseudo graph, directed and undirected graphs, degree of a vertex, handshaking theorem, Types of graphs, sub graphs and isomorphic graphs, bipartite graphs, operations of	10

	graphs, representation of graphs.	
4	Paths, Cycles ,cut vertex, cut set and bridge, Connectedness in directed and undirected graphs, Connectivity, Eulerian graph, Hamiltonian graph, Dijkstra's algorithm for shortest path, planar graphs, Euler's formula, Graph coloring, Wetch Powell algorithm, Chromatic polynomial, Decomposition theorem.	10
5	TREES: Trees and their properties, Rooted tree, Spanning tree, minimal spanning tree, fundamental circuits, rank and nullity, Kruskal's algorithm, Binary tree.	8
	TOTAL	**48**

11 Suggested Books:

Sl. NO.	NAME OF AUTHERS/BOOKS/PUBLISHERS	YEAR OF PUBLICATION/ REPRINT
1	J. K. Sharma, "Discrete Mathematics", Macmillan	2006
2	Liptschutz, Seymour, "Discrete Mathematics", TMH	2007
3	Trembley, J.P & R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", TMH	2004
4	Kenneth H. Rosen, " Discrete Mathematics and its applications", TMH	2002
5	Doerr Alan & Levasseur Kenneth, "Applied Discrete Structures for Computer Science", Galgotia Pub. Pvt. Ltd	2001
6	Gersting,"Mathematical Structure for Computer Science",WH Freeman & Macmillan	1998
7	Kumar Rajendra, "Theory of Automata: Languages and Computation", PPM	2009
8	Hopcroft J.E, Ullman J.D., "Introduction to Automata theory, Languages and Computation", Narosa Publishing House, New Delhi	2007

Course Name: Operating Systems **Subject Code:** TBI 205

Program Name: Bachelor of Science (Information Technology)

1 Contact Hours: 45 **L** 3 **T** 0 **P** 0

2 Examination Duration (Hrs): **Theory** 0 3 **Practical** 0 0

3 Relative Weightage: **CWE:** 25 **MTE:** 25 **ETE:** 50

4 Credits: 0 3

5 Semester:

	*	
Autumn	**Spring**	**Both**

6 Pre-Requisite: Fundamental knowledge of computers and information technologies

7 Subject Area: Computer Science

8 Objective: To familiarize students with the Concept of Operating Systems that are used to manage various system components including files and processes.

9 Course Outcome:

A student who successfully fulfills the course requirements will be able to:

CO 1 Classify operating systems as per user or process requirements

CO 2 Evaluate and implement an appropriate CPU scheduling algorithm to improve overall system throughput along with improved average turnaround time, waiting and response time.

CO 3 Identify and design a suitable solution for different issues, such as process synchronization and deadlock, that are associated with simultaneous execution of multiple processes.

CO 4 Analyze and compare different algorithms given for management of the primary memory (RAM).

CO 5 Evaluate and select an appropriate mechanism for improved management of files and directories.

CO 6 Analyze and select a suitable security solution for protection of his/her system's resources.

10 Details of the Course:

Unit No.	CONTENT	CONTACT HOURS

1	**Introduction:** Operating systems and its definition. History of Operating system. Types of operating system. Single-User, Multi-User, Multiprogramming, Multiprocessing, Batch Systems, Parallel, Distributed and Real-time systems. Operating system structure and its services, System calls.	10
2	**Operating system components:** Process Management, Program and Process concept, Process scheduling, CPU scheduling criteria, Types of Schedulers, Scheduling algorithms, Multiple-processor scheduling, Threads.	10
3	**Process Synchronization and Deadlocks:** Independent and cooperative process, Inter process communication, Critical regions, The Critical-Section problem, Two process & multiple process solution, Peterson Algorithm, Bakery Algorithm, Semaphores, Deadlocks-System model, Characterization, Deadlock prevention, Avoidance and Detection, Recovery from deadlock	13
4	**Memory and Storage management:** Memory Management-Logical and Physical Address Space, Contiguous and non-contiguous allocation, Paging, Virtual Memory, Demand paging and its performance, Page replacement algorithms, File systems, secondary Storage Structure, File concept, access methods, directory implementation. Disk structure, Disk scheduling methods, Disk management, Recovery, Protection and Security.	6
5	**LINUX Case Study:** Historical development of LINUX and its variants. Types of files in LINUX. Directory handling and Navigation. Absolute and Relative pathnames. File handling commands. Changing file permission. Shell Programming, command line arguments, Meta-characters. Shell variables, Test Command, The Logical and relational Operators, String handling and computation.	6
	TOTAL	**45**

11 Suggested Books:

Sl. NO.	NAME OF AUTHERS/BOOKS/PUBLISHERS	YEAR OF PUBLICATION
1	Silberschatz, Galvin: Operating System Concept, 7th Edition, John Wiley and Sons.	2005
2	William Stallings: Operating Systems: Internals and Design Principles, 7th Edition PHI.	2012
3	Sumitabha Das: UNIX Concepts and Application, 4th Edition, McGraw Hill	2008

Program Name: B.Sc. (IT)

Course Name: Environmental Studies **Subject Code:** TEV 222

1 Contact Hours: 48 **L** 1 **T** 0 **P** 0

2 Examination Duration (Hrs): **Theory** 0 3 **Practical** 0 0

3 Relative Weightage: **CWE:** 25 **MTE:** 25 **ETE:** 50

4 Credits: 0 1

5 Semester: ☐ **Autumn** ☑ **Spring** ☐ **Both**

6 Pre-Requisite: Basic knowledge of Environment

7 Subject Area: Environmental Studies

8 Objective: To familiarize students with the Environmental issues.

9 Course Outcome: A student who successfully fulfills the course requirements will be able to-

- **a.** Understand the natural environment and its relationships with human activities.
- **b.** Characterize and analyze human impacts on the environment.
- **c.** Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
- **d.** Understand the Important Environmental Issues, Management and legislation.
- **e.** Project work/Assignment on recent environmental issues and reporting/ Review writing.

10 Details of the Course:

Unit No.	CONTENT	CONTACT HOURS
1	**Ecology and ecosystem:** General Introduction (Scopes and Importance, Components and Segments), Ecosystem (components and structure, energy and nutrient flow, food chain, food web), UNCED (1972), Earth Summit (1992), Rio+20 (2012), UNFCC, CBD.	10
2	**Natural Resources and Biodiversity:** Energy Resources (Renewable/Non-renewable; Traditional/Alternative) and types (Hydel, Solar, Wind, Geothermal). Forest Resources: types and benefits from forest and Sustainable Forest Management, Forest (Conservation) Act, 1980. Water resources: Water resources in Himalayan region, Dams and their impacts, Rain water harvesting and Watershed development, Law and Policy. Biodiversity: Definition and Types, importance, threats and Hotspots, Biodiversity conservation (in situ, ex situ) threatened categories as per IUCN, Law and Policy.	10

	Remote sensing and Geographical Information System (GIS) and applications in environmental management.	
3	**Environmental Pollution:** Air Pollution: Definition, sources, classification and its effects, control strategies and devices, Law and Policy. Water Pollution: Definition, sources, Impacts and toxic effects of some specific pollutants, measurement of DO/BOD/COD, Bio-accumulation and Bio-magnification, Law and Policy. Waste water treatment (Aerobic and anaerobic) and Sewage Treatment Plant. Thermal Pollution and Radioactive pollution and its hazards, Noise pollution.Soil pollution: Definition, sources and solid waste management.	10
4	**Important Environmental Issues, Management and legislation:** Climate change, global warming, smog, ozone layer depletion, acid rain, floods, river blockades, cloud bursting, landslides and earthquakes effects and mitigation. Environmental Impact Assessment (Aims, objectives, constraints in EIA), Environment Assessment Process, EIS, Environment Audit (Introduction and methodology) and Environmental Certification Sustainable Development, Environment and human health. Environmental Management System (EMS), Environmental (Protection) Act 1986, ISO norms	10
5	**Field /Project Work:** Visit and documentation of protected habitats/ Sites/ Research Institutions/ Industries. Project work/Assignment on recent environmental issues and reporting/ Review writing.	8
	TOTAL	**48**