Graphic Era Hill University, Dehradun

SEMESTER III

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS-308** Course Title: **Logic Design & Computer Organization**
2. Contact Hours: **L:** 3 **T:** 0 **P:** 0
3. Examination Duration (Hrs): **Theory** 3 **Practical** 0
4. Relative Weight: **CIE** 25 **MSE** 25 **SEE** 50
5. Credits: 3
6. Semester: 3
7. Category of Course: DC
8. Pre-requisite: Basic Electronics Engineering (TEC 101/201)

9. **Course Outcome:**	After completion of the course the students will be able to**:** CO1: Understand the process of minimizing Boolean function and obtaining the combinational logic circuits from Boolean functions. CO2: Analyze the basic storage elements in digital circuits and develop sequential circuits by applying them. CO3: Evaluate the design of different types of register, counter, and programmable logic devices. CO4: Apply the concept of digital logic circuits in computer organization & architecture and evaluate the computer performance. CO5: Create the arithmetic logic used in computer and describe the machine instruction execution. CO6: Understand the memory hierarchy of computer and how different I/O devices interact with the processing unit.

*** Describe the specific knowledge, skills or competencies the students are expected to acquire or demonstrate.*

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	**Unit 1:** Simplification of Boolean Function using K-map method (upto 5 variables) and Quine-Mc Clusky method. Nand and Nor Implementation. Combinational Logic: Introduction, Analysis & Design Procedure, Binary Adder & Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, Demultiplexers, code conversion. Introduction to HDL description of combinational logic circuits.	10
2	**Unit 2**: Sequential Logic: Introduction, Types of Sequential circuits, Basic storage elements (Latch and Flip-flops), Characteristic equations & tables, excitation	8

	table, Flip-flop conversion, Analysis and design of synchronous sequential circuits.	
3	**Unit 3:** Registers, Shift register, Universal shift register, Counters (Ripple & Synchronous): Introduction & Design, Introduction to memory, types of memory, PLD: PAL, PLA, ROM Introduction to Computer Organization & Architecture, Von Neumann and Harvard Architecture, RISC and CISC machines, Evolution of Intel x86 and ARM architecture, Basic measures of computer performance, Amdahl's Law, Little's Law.	10
4	**Unit 4:** Computer Arithmetic (Integer and Floating Point): Representation, Addition, Subtraction, Multiplication and Division. Machine Instruction characteristics, Addressing Modes, Processor structure and operation, Instruction Cycle, Instruction Pipelining: Strategy, performance, Hazards. Control unit operation and microprogrammed control.	10
5	**Unit 5:** Memory hierarchy: Locality and performance, Cache memory: Principles and elements of design, Internal memory, External memory, I/O interface: External devices, I/O modules, Programmed I/O, Interrupt driven I/O, Direct Memory Access. Introduction to alternative architectures.	10
	Total	**48**

11. Suggested Books:

S.No	Name of Authors/Books/Publishers	Edition	Year of Publication / Reprint
	Textbooks		
1.	M. Morris Mano, Digital Logic and Computer Design, Pearson	1st	2016
2.	W. Stalling, Computer Organization and Architecture, Pearson	11th	2022
	Reference Books		
1.	Charles H. Roth Jr., Fundamentals of Logic Design, Wadsworth Publishing	5th	2005
2.	John P Hayes, Computer Architecture and Organization, McGraw Hill	3rd	2017

12.	**Mode of Evaluation**	Test / Quiz / Assignment / Mid Term Exam / End Term Exam

Graphic Era Hill University, Dehradun

SEMESTER III

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 302** Course Title: **Data structures with C**
2. Contact Hours: **L:** 3 **T:** 0 **P:** 0
3. Examination Duration (Hrs): **Theory** 3 **Practical** 0
4. Relative Weight: **CIE** 25 25 **SEE** 50
5. Credits: 3
6. Semester: III
7. Category of Course: DC
8. Pre-requisite:

9. **Course Outcome**:**	After completion of the course the students will be able to**:** CO1: Describe the concept of Data Structures and assess how the choice of data structures impacts the performance of programs CO2: Compare and contrast merits and demerits of various data structures in terms of time and memory complexity. CO3: Identify and propose appropriate data structure for providing the solution to the real world problems. CO4: Implement operations like searching, insertion, deletion, traversing mechanism etc. on various data structures CO5: Be familiar with advanced data structures such as balanced search trees, hash tables, AVL trees, priority queues, ADT etc. CO6: To augment merits of particular data structures on other data structure to develop innovation in subject of study.

*** Describe the specific knowledge, skills or competencies the students are expected to acquire or demonstrate.*

10. Details of the Course:

SL. NO.	Contents	Contact Hours
1	**Unit 1:** **Introduction:** Basic Terminology, Pointer and dynamic memory allocation, Elementary Data Organization, Data Structure operations, Algorithm	**10**

	Complexity and Time-Space trade-off Arrays**:** Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Array as Parameters, Ordered List, Sparse Matrices. Stacks:Array. Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Recursion: **Recursive** definition and processes, recursion in C, example of recursion, Tower of Hanoi Problem, tail recursion.	
2	**Unit 2:** **Queues:** Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty. Circular queue, Dequeue, and Priority Queue**.** **Linked list**: Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list.	**10**
3	**Unit 3:** **Trees**: Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree. Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees. Traversing Threaded Binary trees, Huffman algorithm & Huffman tree**.** **Searching and Hashing**: Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation	**9**
4	**Unit 4:** ***Sorting****:* Insertion Sort, Bubble Sorting, Quick Sort, Two Way Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting. **Binary Search Trees**: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees	**9**
5	**Unit 5:** **File Structures**: Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B+ Tree index Files, B Tree index Files, Indexing and Hashing Comparisons, Graph, Traversal(DFS,BFS) ,Minimum spanning tree	**8**
	Total	**46**

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication / Reprint

	Textbooks		
1.	Horowitz and Sahani, “Fundamentals of data Structures”, Galgotia Publication Pvt. Ltd., New Delhi.	2nd	**2008**
2	R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education Asia,	2nd	**2006**
3	A. M. Tenenbaum, “Data Structures using C & C++”, Prentice-Hall of India Pvt. Ltd., New Delhi.	2nd	2014
4	K Loudon, “Mastering Algorithms with C”, Shroff Publisher & Distributors Pvt. Ltd.	1st	2000
5	Bruno R Preiss, “Data Structures and Algorithms with Object Oriented Design Pattern in C++”, Jhon Wiley & Sons, Inc.	1st	1998
6	Adam Drozdek, “Data Structures and Algorithms in C++”, Thomson Asia Pvt	4th	2013

12.	**Mode of Evaluation**	Test / Quiz / Assignment / Mid Term Exam / End Term Exam

Graphic Era Hill University, Dehradun

SEMESTER III

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 307** Course Title: **Object Oriented Programming with C++**
2. Contact Hours: **L:** 3 **T:** 0 **P:** 0
3. Examination Duration (Hrs): **Theory** 3 **Practical** 0
4. Relative Weight: **CIE** 25 **MSE** 25 **SEE** 50
5. Credits: 3
6. Semester: III
7. Category of Course: DC
8. Pre-requisite: **Subject Name with Code**

9. **Course Outcome**:**	After completion of the course the students will be able to**:** CO1: Demonstrate the C++ Program uses data types, operators, expressions, array, strings and functions. CO2: Implement Constructors (Parameterized, Copy), this pointer, friend function, dynamic objects, arrays of objects. CO3: Illustrate the Operator Overloading of +, -, preincrement, postincrement, << and >>. CO4: Implement the single, multiple, multilevel and hybrid inheritance in C++. CO5: Illustrate function overloading, Overriding and virtual functions. CO6: Carry out exception handling techniques and provide solutions to storage related problems using STL.

*** Describe the specific knowledge, skills or competencies the students are expected to acquire or demonstrate.*

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	**Unit 1:** **Introduction:** Need of object-oriented programming, Overview of C++, Header Files and Namespaces, Sample C++ program, Different data types, operators, expressions, and statements, arrays and strings, pointers & user-defined types function components, argument passing, inline functions, recursive functions.	10

2	**Unit 2:** **Classes & Objects:** Class Specification, Objects, Scope resolution operator, Access members, defining member functions, Data hiding, Constructors, Parameterized constructors, Destructors, Static data members, Friend functions, passing objects as arguments, Returning objects, Arrays of objects, Dynamic objects, Pointers to objects, Copy constructors, This Pointer. **Operator overloading:** Fundamentals of Operator Overloading, Overloading Binary Operators and unary operators, Operator overloading using friend functions such as +, -, pre-increment, post-increment, overloading of << and >>.	9
3	**Unit 3:** **Inheritance:** Necessity of inheritance, Types of inheritance with examples, Base Class and Derived class, Public, private and protected access modifiers, inheriting multiple base classes, working of Constructors and Destructors in Inheritance, Passing parameters to base class constructors, Virtual base classes	9
4	**Unit 4:** **Virtual functions and Polymorphism**: Polymorphism, function overloading, Overriding Methods, Virtual function, Calling a Virtual function through a base class reference, Pure virtual functions, Abstract classes, Virtual Destructors, Early and late binding	9
5	**Unit 5:** **I/O System Basics and STL:** C++ stream classes, I/O manipulators, fstream and the File classes, basic file operations, function templates Exception Handling: Exception handling fundamentals, Throwing an Exception, Catching an Exception, Re-throwing an Exception, An exception example. **STL:** An overview, containers, vectors, lists, maps, Algorithms	9
	Total	**46**

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication / Reprint
	Textbooks		
1.	Herbert Schildt,The Complete Reference C++, McGraw Hill	4th	2017
2	Balagurusamy E,Object oriented Programming with C++	8th	2020
	Reference Books		
1.	Paul Deitel and Harvey Deitel, C++: How to Program, Pearson	10th	2016

12.	**Mode of Evaluation**	Test / Quiz / Assignment / Mid Term Exam / End Term Exam

Graphic Era Hill University, Dehradun

SEMESTER III

Name of Department: - Computer Science and Engineering

1. Subject Code: **TMA 316** Course Title: **Discrete Structures and Combinatorics**
2. Contact Hours: **L:** 3 **T:** 1 **P:** 0
3. Examination Duration (Hrs): **Theory** 3 **Practical** 0
4. Relative Weight: **CIE** 25 **MSE** 25 **ESE** 50
5. Credits: 4
6. Semester: III
7. Category of Course: DC
8. Pre-requisite: TMA101 Engineering Mathematics-I
   TMA201 Engineering Mathematics-II

9.**Course Outcome**:**	After completion of the course the students will be able to**:** CO1: Be able to specify and manipulate basic mathematical objects such as sets, functions, and relations . Demonstrate an understanding of partial order relations and Lattices. CO2: Understand the basics of discrete probability and number theory, and be able to apply the methods from these subjects in problem solving. CO3: Produce convincing arguments, conceive and/or analyze basic mathematical proofs and discriminate between valid and unreliable arguments. CO4: Discriminate, identify and prove the properties of groups and subgroups CO5: Be able to apply basic counting techniques to solve combinatorial problems CO6: Demonstrate different traversal methods for trees and graphs. Model problems in Computer Science using graphs and trees.

*** Describe the specific knowledge, skills or competencies the students are expected to acquire or demonstrate.*

10. Details of the Course:

SL. NO.	Contents	Contact Hours
1	**Unit 1:** **Relations and Functions:** Review of Sets,	**11**

	Relations - properties, equivalence relation, matrix and Graph representation, Closure operations Functions, Types of functions, Invertability, Composition of functions and Inverse functions,Partially ordered Sets and Lattices. Lattice Properties, Lattices as Boolean Algebra	
2	**Unit 2:** **Probability Theory** Basics of Probability, Conditional Probability; Random Variables, probability mass and density function, commutative distribution function, expected values, mean, variance and standard deviation, Distributions: Binomial. Poisson, normal, uniform,, exponential,	**9**
3	**Unit 3:** **Fundamentals of Logic:** Basic Connectives and Truth Tables, Logical Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, **Methods of Proof:** Different methods of proof – Direct Proof, Indirect Proof, Counter examples, Principle of Induction.	**9**
4	**Unit 4:** **Groups:** Definitions, Examples, and Elementary Properties, Homomorphism, Isomorphism, permutation groups and cyclic Groups, subgroups, cosets, and Lagrange's Theorem **Counting:** Set cardinality and counting, Sum and Product Rules, Inclusion Exclusion Principles, Pigeonhole principle, permutations and combinations, Basics of recurrence relations and, generating Functions	**10**
5	**Unit 5:** **Graphs and Trees** Fundamentals of Graphs Graph types – undirected, directed, weighted; - Representing graphs and graph isomorphism -connectivity-Euler and Hamilton paths, Isomorphism Tree properties, traversal techniques;	**9**
	Total	**48**

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication / Reprint
	Textbooks		
1.	Kenneth H. Rosen:" Discrete Mathematics and its Applications", , McGraw Hill,.	6th Edition	2007
2	JayantGanguly: "A Treatise on Discrete Mathematical Structures", Sanguine-Pearson,.	2nd	2011
	Reference Books		
1.	D.S. Malik and M.K. Sen: "Discrete Mathematical Structures: Theory and Applications", Thomson,.	2nd	2004
2	Thomas Koshy:" Discrete Mathematics with Applications", Elsevier,.	1st	2005, Reprint 2008
3	Ralph P. Grimaldi:" Discrete and Combinatorial Mathematics" Pearson Education,.	5th	2004

4	S.B.Singh, Jaikishor and Ekata, "Discrete Mathematics", Khanna Publication,.	3rd	2011

12.	**Mode of Evaluation**	Test / Quiz / Assignment / Mid Term Exam / End Term Exam

Graphic Era Hill University, Dehradun

SEMESTER III

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS-343** Course Title: Mathematical Foundations for Artificial Intelligence

2. Contact Hours: **L:** **3** **1** **0**

3. Examination Duration (Hrs): **Theory** **3** **tical** **0**

4. Relative Weight: **CIE** **25** **MSE** **25** **50**

5. Credits: **4**

6. Semester: **III**

7. Category of Course: **DC**

8. Pre-requisite: **TMA 101 Engineering Mathemaics I, TMA 201 Engineering Mathemaics II**

9. **Course Outcome**:**	After completion of the course the students will be able to**:** CO1: Understand the basic concepts of Linear Algebra such as System of Linear Equation, Matrices, Vector Space, Rank, etc. CO2: Understand the basic principles of probability, Bayes theorem, understand the definitions of discrete, continuous, and joint random variables, compute the mean, variance and covariance of random variables. CO3: Solve problems on matrix decompositions such as Choleskey Decomposition, Eigen Decomposition and Diagonalization, Singular Value Decomposition CO4: Describe the vector calculus concepts such as differentiation of Univariate Function, Partial Differentiation and Gradients. CO5: Analyze various mathematical concepts, that are required to build AI & ML models. CO6: Create an AI & ML models by applying the concepts of mathematics such as Linear Algebra, Analytical Geometry, Matrix, Calculus, Probability, etc.

*** Describe the specific knowledge, skills or competencies the students are expected to acquire or demonstrate*

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	**Unit 1:** **Linear Algebra:** System of Linear Equation**,** Matrices, Solving system of Linear Equation, Vector Spaces, Linear Independences, Basis and Rank, Linear Mappings, Affine Space.	10

2	**Unit 2:** **Analytic Geometry:** Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal basis, Orthogonal Compliment, Inner Product of Function, Orthogonal Projections, Rotations.	10
3	**Unit 3:** **Matrix Decomposition** Determinant and Trace, Eigen Values and Eigen Vectors, Choleskey Decomposition, Eigen Decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation, Matrix Pylogency	10
4	**Unit 4:** **Vector Calculus** Differentiation of Univariate Function, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Linearization and Multivariate Taylor Series	10
5	**Unit 5:** Probability and Distribution Discrete and Continuous Probability, Sum Rule, Product Rule, Bayes' Theorem, Gaussian Distribution, Change of Variables/Inverse Transform	10
	Total	**50**

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication / Reprint
	Textbooks		
1.	Marc Peter Deisenroth , A. Aldo Faisal, Cheng Soon Ong, MATHEMATICS FOR MACHINE LEARNING, Cambridge University Press	1st	2020
2.	Jay Dawani, Hands-On Mathematics for Deep Learning: Build a solid mathematical foundation for training efficient deep neural networks, Packt Publishing Limited	1st	2020
	Reference Books		
1.	Tamoghna Ghosh , Shravan Kumar Belagal Math, Practical Mathematics for AI and Deep Learning, BPB Publications	1st	2022

12.	**Mode of Evaluation**	Test / Quiz / Assignment / Mid Term Exam / End Term Exam

Graphic Era Hill University, Dehradun

SEMESTER III

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 351** Course Title: **Fundamental of Cloud Computing and Bigdata**
2. Contact Hours: **L:** 3 **T:** **P:**
3. Examination Duration (Hrs): **Theory** **Practical**
4. Relative Weight: **CIE** 25 **MSE** 25 **SEE** 50
5. Credits: 3
6. Semester: III
7. Category of Course: DE
8. Pre-requisite: NA

9. **Course Outcome**:**	After completion of the course the students will be able to**:** CO1: Identify the importance of cloud computing services for the digital ag technologies. CO2: Differentiate the services and deployment models of cloud computing. CO3: Evaluate the case studies of the different types of cloud computing applications. CO4: Analyze the cloud computing services management techniques, providers, and standards. CO5: Distinguish the cloud computing services using Bigdata and big data analytics CO6: Design and deploy a cloud based web application.

*** Describe the specific knowledge, skills or competencies the students are expected to acquire or demonstrate.*

10. Details of the Course:

Sl. No	Contents	Contact Hours
1	**Unit 1:** Introduction to Cloud Computing, Vision, History, Evolution, and Characteristics o Cloud Computing (NIST), Characteristic, Advantages and Disadvantages of Clou	9

	Computing, Cloud computing vs. Cluster computing vs. Grid computing, Importanc of Open Standards for digital age technologies.	
2	**Unit 2:** Working of Cloud Computing, Cloud Computing comparison with traditiona computing architecture (client/server), Impact of Networks, Web Development ar User Interface (UI) on Cloud computing. Cloud Deployment Models: Public cloud, Private cloud, Hybrid cloud, Communit cloud.	9
3	**Unit 3:** Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Servic (PaaS), Software as a Service (SaaS). Infrastructure as a Service (IaaS): IaaS definition, Virtualization, Hypervisors Machine Image, Virtual Machine (VM), Resource Virtualization, Server, Storage Networking, Virtual Machine (resource) provisioning and manageability, Da centre physical plant/building, Networking firewalls/security, Data storage in clou computing (storage as a service), Amazon Elastic Compute Cloud (EC2), Eucalyptus Open Stack, Case Study of IaaS. Platform as a Service (PaaS): PaaS definition, Service Oriented Architecture (SOA Cloud Platform and Management, Development tools, database management, busines analytics, Operating systems, Google App Engine, Microsoft Azure, and Salesforce Case Study of PaaS. Software as a Service (SaaS): SaaS definition, Web services, Web 2.0, Case Study o SaaS.	9
4	**Unit 4:** Introduction to Big Data, Characteristics, Architectures, Technologies, Applications Advantages and Disadvantages of Big Data, Tools and Techniques applied in Big Data Association rule learning, Classification tree analysis, Genetic algorithms, Machin learning, Regression analysis, Sentiment analysis, Social network analysis, Differenc between big data and big data analytics. Introduction to Big Data analytics, Data Analysis Techniques: A/B testing, Data fusio and data integration, Data mining, Machine learning, Natural language processin (NLP), Statistics. Case study of Big Data.	9
5	**Unit 5:** Foundations Services of AWS: Savings, Security, Compliance and DRaa Development Operations. AWS Services: Amazon Lambda, Amazon Relationa Database Service (Amazon RDS), Amazon S3, Amazon CloudFront, Amazon Glacie and Amazon SNS. Service Management in Cloud Computing: Service Level Agreements (SLAs), Billin & Accounting. Economics of Cloud Computing: SWOT Analysis and Value Proposition, Genera Cloud Computing Risks, (Performance, Network Dependence, Reliability, Outages Safety Critical Processing Compliance and Information Security. Design and Deploy an Online Video Subscription Application on the Cloud.	9
	Total	**45**

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication Reprint
	Textbooks		
1.	Rajkumar Buyya, Cloud Computing Principles and Paradigms Wiley,	1st	2013
2	Kannammal, Fundamentals of Cloud Computing, Cengag Learning,	1st	2015
3	Cloud Computing Bible, Barrie Sosinsky, Wiley-India,	1st	2011
	Reference Books		
1.	Jared Dean, Bigdata Data Mining and Machine Learning Wiley,	1st	2014
2	Vince Reynolds, Bigdata for Beginners, Create spac Independent Publishing Platform,	1st	2016

12.	**Mode of Evaluation**	Test / Quiz / Assignment / Mid Term Exam / End Term Exam

Graphic Era Hill University, Dehradun

SEMESTER III

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 392** Course Title: **Introduction to Cryptography**
2. Contact Hours: **L:** 3 **T:** **P:**
3. Examination Duration (Hrs): **Theory** **Practical**
4. Relative Weight: **CIE** 25 **MSE** 25 **SEE** 50
5. Credits: 3
6. Semester: III
7. Category of Course: DE
8. Pre-requisite: NA

9. **Course Outcome**:**	After completion of the course the students will be able to**:** CO1:Classify security vulnerabilities involved in data communication over Internet and makeuse of classical algorithms to address the vulnerabilities. CO2: Apply symmetric block ciphers to secure data transmission and storage CO3: Analyze the various public key cryptographic systems and usage of hashing CO4 Appreciate the design of Public Key algorithms, mathematical background and make useof the same for data communication and message authentication CO5: Categorize types of viruses, worms, intrusion and decide measures to counter thethreats. CO6: Understand the legal aspects related to Cybercrime, Intellectual Property, Privacy,Ethical Issues.

*** Describe the specific knowledge, skills or competencies the students are expected to acquire or demonstrate.*

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	**Unit – 1:** Introduction: Computer Security Concepts: The OSI SecurityArchitecture, Security Attacks, Security Services, Security Mechanisms, a Model for Network Security, Standards Cryptography fundamentals and terminology; Cryptanalysis and Brute-Force Attack, Fundamental techniques of cryptography Substitution and Transposition; Classical Ciphers; Basics of Steganography.	8
2	**Unit – 2:** Modern Cryptography: Symmetric Encryption and MessageConfidentiality:	9

	Symmetric Encryption Principles, Fiestal structure. Symmetric Block Encryption Algorithms, Simple DES, double DES, Stream Ciphers and RC4, Random and Pseudorandom Numbers.	
3	**Unit – 3:** Symmetric key distribution using symmetric encryption: A Key Distribution Scenario, Session Key Lifetime, A Transparent Key Control Scheme, Decentralized Key Control, Controlling Key UsageMathematical Background for cryptography: prime number, Euclidean algorithm for GCD, Extended Euclidean algorithm for multiplicative inverse, Euler's totient function, their programming implementation.	10
4	**Unit 4:** Public-Key Cryptography: Public-Key Encryption Structure, Applications for Public-Key Cryptosystems, Requirements for Public-Key Cryptography, The RSA Public-Key Encryption Algorithm. Message Authentication: Approaches to Message Authentication, Authentication Using Conventional Encryption, Message Authentication without Message Encryption, MD5 Hash Algorithm.	9
5	**Unit 5:** System Security: Intruders, Intrusion Detection, Password Management, Types of Malicious Software, Viruses, Virus Countermeasures, Worms and Principles of Firewalls Legal and Ethical Aspects: Cybercrime and Computer Crime, Intellectual Property, Privacy, Ethical Issues.	8
	Total	**44**

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication / Reprint
	Textbooks		
1.	William Stallings, Network Security Essentials Applications and Standards, ,Pearson Education,	6th	2018
2	William Stallings , Cryptography and Network Security, Pearson Education,	7th	2017
	Reference Books		
1.	Behrouz Forouzan , Cryptography and Network Security, McGraw Hill,	3rd	2015
2	Atul Kahate, "Cryptography and Network Security", McGraw Hill Education,,	3rd	2017

12.	**Mode of Evaluation**	Test / Quiz / Assignment / Mid Term Exam / End Term Exam

Graphic Era Hill University, Dehradun

SEMESTER III

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS346** Course Title: **Python Programming**
2. Contact Hours: **L:** 3 **T**: 0 **P**: 0
3. Examination Duration (Hrs): **Theory** 3 **Practical** 0
4. Relative Weight: **CIE** 25 **MSE** 25 **ESE** 50
5. Credits: 3
6. Semester: 3
7. Category of Course: **DSC**
8. Pre-requisite: Fundamental of Computer & Introduction to Programming (TCS101), Programming for problem solving (TCS201)

9. **Course Outcome:**	After completion of the course, the students will be able to**:** CO1: Identify and describe the fundamental data types and basic operators used in Python programming. CO2: Explain the purpose and usage of functions in Python, including parameters, return values, and modules. CO3: Apply data structures like lists, tuples, and dictionaries to organize and manipulate data for engineering problems. CO4: Analyze the differences between object-oriented programming concepts like inheritance, polymorphism, and encapsulation, and their impact on program design. CO5: Evaluate the suitability of various libraries like NumPy, Pandas, Matplotlib, and Seaborn for specific tasks related to numerical computing, data analysis, and visualization in engineering applications. CO6: Design and implement Python programs using fundamental concepts, data structures, and libraries to solve basic engineering problems involving data cleaning, analysis, and visualization.

10. **Details of the Course:**

Sl. No.	Contents	Contact Hours
1	**UNIT 1: Python Basics and Functions and Modules** Syntax and Semantic Basics: Data types: strings, integers, floats, Variable assignments and expressions, Basic input/output operations Defining and calling functions: Function parameters and return values- Using built-in modules, Creating and using custom modules, Exception handling basics	10
2	**UNIT 2: Data Handling** Lists: creation, indexing, slicing, and methods Tuples: usage and when to use Dictionaries: creating, accessing, and manipulating Reading from and writing to files: text and binary files	8
3	**UNIT 3: Object-Oriented Programming** Introduction to classes and objects, Attributes and methods, Inheritance: extending classes Polymorphism: using a unified interface Encapsulation: private and public members	10
4	**UNIT 4: Libraries for AI/ML** NumPy: arrays, array operations, indexing, reshaping Pandas: DataFrame operations, indexing, merging, grouping Matplotlib: basic plotting, figures, and axes Seaborn: statistical data visualization	10
5	**UNIT 5: Intro to Data Science** Data cleaning techniques, Exploratory data analysis (EDA): summary statistics, correlation, Visualization techniques: histograms, scatter plots, box plots	8
	Total	**46**

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
Eric Matthes	Python Crash Course: A Hands-On, Project-Based Introduction to Programming	3rd Edition	No Starch Press, USA	2023
Mark Lutz	Learning Python	5th Edition	O'Reilly Media, USA	2013
Wes McKinney	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython	2nd Edition	O'Reilly Media, USA	2017

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Joel Grus	Data Science from Scratch: First Principles with Python	2nd Edition	O'Reilly Media, USA	2019
Al Sweigart	Automate the Boring Stuff with Python: Practical Programming for Total Beginners	2nd Edition	No Starch Press, USA	2019

Graphic Era Hill University, Dehradun

SEMESTER III

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS364** Course Title: **Fundamentals of Artificial Intelligence and Machine Learning**
2. Contact Hours: **L:** 3 **T**: 0 **P**: 0
3. Examination Duration (Hrs): **Theory** 3 **Practical** 0
4. Relative Weight: **CIE** 25 **MSE** 25 **ESE** 50
5. Credits: 3
6. Semester: III
7. Category of Course: DSC
8. Pre-requisite: Fundamental of Computer & Introduction to Programming (TCS101)

9. **Course Outcome:**	After completion of the course, the students will be able to**:** CO1: Define Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning, and differentiate between them. CO2: Explain problem-solving frameworks in AI and describe search strategies like breadth-first, depth-first, and A*. CO3: Choose appropriate classification techniques like Logistic Regression, KNN, or SVM based on specific data characteristics. CO4: Compare and contrast different performance metrics like accuracy, precision, recall, and F1-score for evaluating ML models. CO5: Evaluate the strengths and limitations of specific unsupervised learning techniques like K-means and hierarchical clustering for a given task. CO6: Design a simple machine learning pipeline involving data pre-processing, model selection, and evaluation for a classification task.

10. **Details of the Course:**

Sl. No.	Contents	Contact Hours
1	**UNIT 1: Overview of AI and Intelligent Agents** Definition and history of AI, Differences between AI, ML, and deep learning, Applications and impact of AI in various sectors, Agents and environments, Types of agents (simple reflex, model-based, goal-based, utility-based), Agent architecture and environments **Problem Solving:** Problem-solving frameworks, Search strategies: breadth-first, depth-first, A* Heuristics: designing and applying heuristics	9
2	**UNIT 2: Knowledge and Reasoning** Knowledge-based AI, Logic and Reasoning: propositional and predicate logic, Inference in first-order logic, Building knowledge bases. **Uncertainty Handling:** Probabilities and Bayesian networks, Decision making: Expected utility- Markov decision processes	9
3	**UNIT 3: Introduction to ML and Data Preprocessing** What is Machine Learning? Types of Machine Learning: Supervised, Unsupervised, Reinforcement- ML in practice: Applications and case studies, Importance of data preprocessing, Data cleaning, normalization, and transformation, Feature selection, and dimensionality reduction. **Regression Analysis** Linear regression, Polynomial regression, Regularization methods: Ridge, Lasso	10
4	**UNIT 4: Classification Techniques** Logistic regression, K-nearest neighbors (KNN), Support vector machines (SVM) **Decision Trees and Random Forests** Building decision trees, Overfitting and pruning, Ensemble methods: Random Forests and boosting	10
5	**UNIT 5: Evaluation of ML Models and Clustering and Association** Training and testing data splits, Performance metrics: accuracy, precision, recall, F1-score, Confusion matrix and ROC curves K-means clustering, Hierarchical clustering, Apriori algorithm for association rule learning	10
	Total	**48**

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
Stuart Russell and Peter Norvig	Artificial Intelligence: A Modern Approach	4th Edition	Pearson Education Limited, USA	2024
Melanie Mitchell	Introduction to Artificial Intelligence	2nd Edition	McGraw-Hill Education, USA	2024
Tom M. Mitchell,	Machine Learning	1st Edition	Mc Graw Hill Publisher	2017
Manaranjan Pradhan, U Dinesh Kumar	Machine Learning using Python	1st Edition	Wiley, India	2017

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Richard E. Neapolitan and Kevin Goda	Artificial Intelligence: Foundations and Applications	4th Edition	Elsevier Science & Technology, Netherlands	**2024**
Aurélien Géron	Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow	2nd Edition	O'Reilly Media, Inc., USA	2024
E. Alpaydin,	Introduction to Machine Learning	3rd Edition	PHI Publisher	2015

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SEMESTER III

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS-324** Course Title: **Information Security Foundations**
2. Contact Hours: **L:** 3 **T**: 1 **P**: 0
3. Examination Duration (Hrs): **Theory** 4 **Practical** 0
4. Relative Weight: **CIE** 25 **MSE** 25 **ESE** 50
5. Credits: 3
6. Semester: 3
7. Category of Course: DSE
8. Pre-requisite: **Fundamental of Computers (TCS 101), Programming for problem solving (TCS 201)**

9. **Course Outcome:**	After completion of the course the students will be able to**:** CO1: Explain symmetric and asymmetric key cryptosystems. CO2: Know the working of cryptography techniques. CO3: Analyze the different types of cryptosystems. CO4: Use cryptographic techniques to implement information security protocols. CO5: Apply cryptographic techniques in different applications. CO6: Develop symmetric and asymmetric key cryptosystems.

10. **Details of the Course:**

Sl. No.	Contents	Contact Hours
1	**Unit 1:** **Introduction to information security** What is information security, why we need information security, the zero trust model, overview of ethical hacking Protection against- unauthorized modification, unauthorized deletion and unauthorized access, different types of user authentication techniques, access control techniques Pillars of information security - confidentiality, availability and integrity Steps to fix a cybercrime - Identify cyber threats, analyze and evaluatethreat, treatment Type of hackers - white hat, grey hat, black hat Penetration testing and its phases - reconnaissance, scanning, gaining access, maintaining access, covering tracks. SSL and Transport layer security.	10
2	**Unit 2:** **Basics of cryptography** What is cryptography, what is confidentiality, data integrity, authentication, and nonrepudiation, applications of cryptography - chip based payment cards, digital currencies, computer passwords, digital communications, plaintext, cipher-text, cipher - characteristics of a good cipher, encryption, decryption, Key - significance of key length, symmetric and asymmetric key cryptography, cryptanalysis, OSI security architecture- security attacks, security services, security mechanisms	10
3	**Unit 3:** **Mathematics applied in information security** Concept of divisibility, prime numbers, importance of prime numbers in cryptography, euclid theorem for GCD, extended euclidean algorithm, modular arithmetic, random number generators, deterministic and nondeterministic random number generators, XOR, bit shifts, euler's totient theorem, chinese remainder theorem.	8

4	**Unit 4:** **Symmetric key cryptosystem** Secret Key (symmetric) cryptography - stream and block ciphers, additive and multiplicative ciphers, rail fence technique, playfair cipher, hill cipher, vernam cipher, Vigenère Cipher, RC4 algorithm, DES, 2DES, 2-3DES, 3DES, AES, block cipher modes of operations.	10
5	**Unit 5:** **Asymmetric key cryptosystem, digital signature, and message integrity** RSA, Diffie Hellman key exchange protocol, Elliptic curve cryptography (ECC), ElGamal encryption system. DSS algorithm, RSADS algorithm, ECDSA algorithm, Message integrity, hash functions, MAC functions, HMAC	8
	Total	**46**

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
William Stallings	Cryptography and Network Security: Principles and Practice	8th	Pearson Publication, India	2020

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies	Security in Computing", 5th Edition	**5th**	Prentice Hall, India	**2015**
William Stallings	Network Security Essentials: Applications and Standards	**6th**	Prentice Hall, India	**2016**