

M.P. BHOJ (OPEN) UNIVERSITY

M.Sc. (Cyber Security) - First Year

Duration	Eligibility	Annual Fee
2 Year		

Course Structure & Scheme of Examination

S N	Subject	Assignment		Theory		Total Marks	
		Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks
1	Data Structure Using C++	30	15	70	28	100	43
2	Python Programming	30	15	70	28	100	43
3	Discrete Mathematics	30	15	70	28	100	43
4	Information and Network Security	30	15	70	28	100	43
5	Data Communication & Computer Networking	30	15	70	28	100	43
6	Cryptography	30	15	70	28	100	43
7	Lab: Data Structure Using C++					100	50
8	Lab: Programming in Python					100	50

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MCS 101 Data Structure Using C++

Unit – I

Object Oriented Paradigms and Metaphors : Basic Concepts of Object-oriented Programming Objects
What is C++? A Simple C++ Program Initialization Input with C in Tokens Control Statements
Decisions Nesting Type Conversion.

Data Types Operators and Expressions. Tokens Basic Data Types Constants User Defined Data Types
Derived Data Types Declaration of Variables Operations and Expressions Operator and Function
Overloading Manipulation of Strings Using Operators Polymorphism Streams.

Function in C++ : The Main Function Passing Arguments to Function Returning Values From
Functions Overload Functions Inline Functions Default Arguments,

Unit – II

Class and Objects The Concept of a Class, Classes Versus Objects. Constructor and Destructor :
Constructors, Destructors, Constructors of the String Class, String Class Assignment ,String Access
Operators and Method. Operator Overloading Type Casting

Inheritance : Derived Class Relationships Superclass/Subclass Multiple Inheritance Constructors,
Destructors, and Inheritance Hierarchical Inheritance Hybrid Inheritance Virtual Base Classes.

Unit – III

What Are Pointers? C++ Memory Map Free Store Pointers and Arrays Reserving Dynamic Memory
Freeing Dynamic Memory Polymorphism Virtual Functions Pure Virtual Functions Early vs. Late
Binding.

Input-Output in C++ :Old Vs. Modern C++/I/O C++ Streams Creating Inserters Creating Extractors
Creating Manipulator Functions.

File Handling in C++ Classes for File Stream Operations Opening and Closing A File Manipulations
of File Pointers Random Access Command-Line Arguments. Standard Library Objects The Container
Classes Theory of Operation Vectors Lists Maps Algorithms The String Class.

Unit IV

Data Structures, Primitive and Composite Data types, Abstract Data Type, Algorithm Design,
Program Analysis, Stacks, Representation of Stacks, Application of Stacks, Simulating Recursive
Function Using Stack, Queues, Circular Queue, Deques, Priority Queues. Linked List, Static and
Dynamic Memory Allocation, Pointers, Static and Dynamic Variables, Linear Linked List,
Representation of Linked List, Implementation of Linked List, Concatenation of Linked List, Merging
of Linked List, Reversing of Linked List, Application of Linked List, Doubly Linked List, Circular
Linked List, Generalized List.

Unit – V

Trees, Basic Terminology, Binary Trees, Theorems Associated with Binary Trees, Binary tree Traversal, Implementation of Binary Trees, Deleting From a Binary Tree., Graphs, Definition and Terminology, Representation of Graphs, Path Matrix, Traversal of Graph, Weighted Graphs, Spanning Trees

Hash Table, Hashing Function, Terms Associated with Hash Tables bucket Overflow, Handling bucket Overflows, ISAM, Searching, Sorting.

References :

E. Balaguruswamy, "Object Oriented Programming in C++", TMH.

Robert Lafore, "Object Oriented Programming in C++", Pearson.

M.T. Somashekar, D.S. Guru, " Object-Oriented Programming with C++", PHI. Herbert Schildt, "The Complete Reference C++", Tata McGraw Hill publication. Varsha H. Patil "Data Structure Using C++" Oxford.

Rajesh K. Shukla "Data Structures Using C & C++" Wiley India.

Reema Thareja " Data Structure Using C " Oxford.

D. S Malik "Data Structure Using C++ " Second Edition Cengage.

Kushwaha and Mishra "Data Structure: A programming Approach with C", PHI Learning. A. K Sharma "Data Structure Using C" Pearson.

Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Computer Science Press

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MCS 102 Python Programming

UNIT I

Introduction to Python, use IDE to develop programs, Basic coding skills, working with data types and variables, working with numeric data, working with string data, Python functions, Boolean expressions, selection structure, iteration structure, working with lists, work with a list of lists, work with tuples, work with dates and times, get started with dictionaries

CONTROL FLOW, FUNCTIONS

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT II

LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: Sorting and Searching

Classes in Python: OOPS Concepts, Classes and objects , Classes in Python, Constructors, Data hiding, Creating Classes, Instance Methods, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes, Iterators, generators and decorators.

UNIT III

FILES, MODULES, PACKAGES

I/O and Error Handling In Python :Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data From a File, Additional File Methods, Handling IO Exceptions, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, Working with Directories.

UNIT IV

An Introduction to relational databases: SQL statements for data manipulation, Using SQLite Manager to work with a database, Using Python to work with a database, Creating a GUI that handles an event, working with components.

UNIT V

Implement Machine Learning algorithms: Usage of Numpy for numerical Data, Usage of Pandas for Data Analysis, Matplotlib for Python plotting, Seaborn for Statistical plots, interactive Dynamic visualizations, SciKit for Machine learning.

Suggested Reading:

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach,2016
2. Haltermanpython Mark Lutz, Programming Python, O'Reilly, 4th Edition,2010.
3. ReemaThareja, "Python Programming using Problem Solving Approach", Oxford University Press, 2017
4. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", SecondEdition, Shroff O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/thinkpython/>)
5. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised andUpdated for Python 3.2, Network Theory Ltd., Edition2011

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MCS 103 Discrete Mathematics

Unit – I

Arithmetic Progression, Sequence, Series, Arithmetic Progression, The General Term or Nth Term of an AP., The Sum of n terms of an AP., Arithmetic Mean, AM. of two Given Numbers, Insertion of N AM. Between Two Given Numbers Properties of A P. Geometric Progression, Definition, The Nth Term of G.P., The Sum of N Terms of a G.P., The Sum of an Infinite G.P., Recurring Decimal an Infinite G.P., Geometric Means, Geometric Mean of Two Given Numbers A And B Insertion of N Geometric Means Between Two Quantities Properties of G.P., To Find the Sum of N Terms of the Series. Harmonic Progression, Definition, Harmonic Mean (H.M) of Two Given Numbers Relation between AM., G.M. and H.M.

Unit – II

Miscellaneous Series, , Arithmetic - Geometric Series, The Sum of n Terms of the Arithmetic - Geometric Series Sigma CE) Notation, Sum of first N Natural Numbers, The Sum of the Squares of First n Natural Numbers The Sum of the Cubes of th First n Natural Numbers Method of Difference.

Set Theory, , The Concept of a Set, Notations, Representation of a Set, Types of Sets, Theorem on Subsets, Number of Subsets of a Set, Venn Diagram, Set Operations, Laws of Union of sets, Laws of Intersection of Sets, Law of Complement of a Set, Theorem (on Symmetric Difference) De-Morgan's Laws, Applications of Venn Diagrams.

Unit – III

Ordered Pairs, Relations & Functions Ordered Pairs, Equality of Ordered Pairs, Cartesian Product of Sets, Theorems on Cartesian Products' Relation, Domain and Range of a Relation, Inverse Relation, The Inverse of an Inverse Relation, Binary (or Dyadic) relations , Type of Relations, Equivalence Relations, Equivalence Class, Properties of Equivalence Classes Composition of Two Relations, Partition of a Set, Partial Order, Theorem, Functions (Mapping), Types of Mapping, Other Specific Mappings, Types of Binary Operations, Algebraic Structure, Graph of a Function, Real Valued Map., Product of 'Functions, Method of Construction of Operation Table Countable and-Uncountable Sets.

Group Theory, Introduction-Algebraic Structures, Groups: Definition, Abelian Group, Order of a Group, Semi-group, Some General Properties of Groups, Some Important Theorems on Groups, Theorem on Subgroups, Homomorphism (Definition), Isomorphism (Definition), Theorems on Homomorphism, Definition (Kernel of f), Theorems on Homomorphism, Definition (Cyclic Groups), Fundamental Theorem of Homomorphism,

Unit – IV

Rings and Fields, Quotient Spaces, Rings in General, Some Special Classes of Rings, Field and its Axioms, Sub-ring and Sub-fields, Vector Space, Definition, Linear Combination, Linear Independence and linear Dependence, Basis of Vector Space, Vector Space of linear Transformation, Linear Algebra, Algebra of Quaternions,

Unit – V

Posets and lattices, Partially Ordered Sets (Posets), Totally Order Set, Diagrammatic Representation of a Poset: (House diagrams) Definitions, Maximal Element, Minimal Element, Duality, Product of Two Posets, lattice, Duality and the Idempotent Law, Semi lattices, Complete lattices, Sub lattice, Convex Sub lattice, Distributive lattice, Complements, Complemented lattices. Boolean Algebra & Its Applications Boolean Expressions and Boolean Functions Identities of Boolean Algebra, Duality, Algebra of Switching Circuits.

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MCS 104 Information and Network Security

UNIT I :

Introduction: Needs for Security; Basic security terminologies e.g. threats, vulnerability, exploit etc.; Security principles(CIA), authentication, nonrepudiation; security attacks and their classifications. Hardware and Software Security: Hardware Security, Smart Cards, Biometrics, Virtual Private Networks, Types of VPNs, Trusted Operating Systems, Pretty Good Privacy (PGP), Security Protocols, Security Socket Layer, Transport Layer Security, IPSec, S/MIME.

UNIT II :

Intrusion Detection System and Firewalls: IDS- Infrastructure of IDS, Classification of IDS, Host-based IDS, Network based IDS, Anomaly v/s Signature Detection, Normal Behavior, Patterns-Anomaly Detection, Misbehaviour Signatures-Signature Detection, Parameter Pattern Matching, Managing an IDS. Malicious Software, Safeguards,

UNIT III :

Firewalls, Packet-Filtering Firewalls, Stateful Inspection Firewalls, Proxy firewalls, Guard, Personal Firewalls, Limitations of Firewalls.

Authentication & Integrity – MAC, Hash function, SHA, MD5, HMAC, Digital signature and authentication protocols; Authorization; Access control mechanism; X.509 Digital Certificate.

UNIT IV :

Wireless Security: Wireless Application Protocol, WAP Security, Authentication, Integrity, Confidentiality, Security Issues with Wireless Transport Layer Security (WTLS), Wireless LAN, WLAN Configuration, WLAN Technology consideration, Wireless LAN Security, Access Point Security, Workstation Security, Safeguarding Wireless LANs.

UNIT V:

Web Security: Client/Server Architecture, Security considerations and Threats, Web traffic security approaches, SSL/TLS for secure web services, The Twin concept of “SSL Connection” and “SSL Session”, SSL session state, SSL Connection State, SSL Record Protocol, SSL Handshake Protocol, S-HTTP, Secure Electronic Transaction(SET), Business Requirements, SET Participants, SET Transaction Flow.

UNIT VI:

E-mail, IP and Web Security: E-mail security – PGP, MIME, S/MIME; IP security protocols; Web security – TLS, SSL etc.; Secure Electronic Transaction(SET); Firewall and its types; Introduction to IDPS; Risk Management; Security Planning.

Suggested Reading:

1. Network Security Essentials: Applications and Standards, William Stallings, Pearson Education.
2. Network Security and Management, Brijendra Singh, PHI.
3. Network Security Bible, Eric Cole, Wiley.
4. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security", 6th Edition, Cengage Learning.
5. Stallings William, "Cryptography and Network Security - Principles and Practice", 7th Edition, Pearson.
6. Roberta Bragge, Mark Rhodes, Keith Straggberg, "Network Security the Complete Reference", Tata McGraw Hill Publication,

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MCS 105 Data Communication and Computer Networking

Unit – I

Fundamentals of Data Communication : Analog Versus Digital, Fundamentals of Data Transmission Communication Modes Transmission System, Synchronous System, Communication Channels Modems : Classification of Modems Modem Based on Range Modems Based on Line Modems Based on Operation Mode Modems Based on Synchronization Modems Based on Modulation.

Data Transmission Protocol : Protocols An Overview of Networking The Role of Computer Networks in Development, Transmission Media : Introduction Transmission Concepts and Terms Master Sites Interconnection to Telephone.

Unit – II

Local Area Network : Local Area Network Baseband Versus Broadband LAN Hardware LAN Operating Systems. Implementing LAN : Implementation of LAN Using Fiber-Optic Cables Implementation of LAN Using Wireless Technology Fast LANs Non-standard LANs. Extending LAN.

Unit – III

Data Transmission Network : Telephone Networks, Wan Technologies. TCP/IP and the Internet : History of Internet, Internet2 Internet Services Standards for TCP/IP and the Internet RFCs and the TCP/IP Standardization Process. Network Architectures and OSI, Network Architectures Layering the Communications Process The Need for Layered Solutions Open Systems Interconnection (OSI) Model. Routing and Congestion Control : Routing Concepts Routing in Wide Area Networks Hop By-Hop versus Source Routing Congestion Control, Deadlocks. Queueing Theory: Basic Design Techniques : Basic Concepts, Queueing Model and Factors Traffic Theory Lost Call Rate.

Unit – IV

Wide Area Network : Introduction Network Using WAN and Network Services Communication Protocols Over WAN. Transmission Control Protocol/Internet Protocol (TCP/IP) : LAN Protocol and OSI TCP/IP Protocol Data Transmission by TCP and Ethernet Data Encapsulation Data Routing TCP/IP Services and Application Protocols. Data Link Layer Address : Physical Address. Naming, Addressing, and Routing : Network Layer Addresses Subnet Address Resolution Protocol (ARP) Domain Name System (DNS).

Unit – V

Broadband Network Local Loop Technologies Asymmetric Digital Subscriber Line (ADSL) High Bit-Rate Digital Subscriber Line (HDSL), Line Coding Techniques Wireless Local Loop (WLL).

Security : Basic Requirements of Network Security, Security Levels Data Security Invalid Access/ Possibility of Eavesdropping Firewalls (Access Control) Encryption Security Against Remote Access. Electronic Mail and other Internet Services : Electronic Mail E-Mail Addresses Format of A Mail Message Some Important Features of E-Mail Services Available on The Internet, Electronics Commerce and EDI, Electronic Commerce Internet: A Tool for Electronic Commerce Electronic Data Interchange (EDI), Implementing EDI - Major Considerations User Characteristics and Electronic Commerce , Issues in Electronic Commerce.

BOOKS

1. A.S.Tanenbaum, "Computer Network", 4th edition,PHI
2. Forouzan "Data Communication and Networking 3ed", TMH
3. J.F.Hayes, "Modeling and Analysis of Computer Communication Networks", Plenum Press
4. D.E.Comer, "Internetworking with TCP/IP", Volume Ist & IInd, PHI
5. Willium Stalling, "Data & Computer communications",Maxwell Macmillan International Ed.
6. D.Bertsekas and R.Gallager,"Data Networks", 2nd Ed. ,PHI.
7. G.E. Keiser ,"Local Area Networks ", McGraw Hill, International Ed.
8. Joh R. Vacca, "Wireless Broadband Networks Handbook 3G, LMDS and Wireless Internet" Tata McGraw-Hill, 2001

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MCS 106 Cryptography

UNIT - I :

Introduction of cryptography , Symmetric-key Encryption, Historical Ciphers, Computational Security, Semantic Security and Pseudorandom Generators (PRGs), Perfect secrecy. One-time pad encryption. Characterizations of perfect secrecy, Limitations of perfect secrecy

CPA-Secure Ciphers from PRF, Modes of Operations of Block Ciphers: ECB, CBC etc.; Cryptanalysis of Symmetric Key Ciphers: Linear Cryptanalysis, Differential Cryptanalysis.

UNIT - II :

DES, 3DES, AES and Message Authentication Codes (MAC), Information-theoretic Secure MAC, Cryptographic Hash Functions.

Ideal-Cipher Model, Davies-Meyer construction and Merkle-Damgård Paradigm, Birthday Attacks on Cryptographic Hash Functions, Applications of Hash Functions,

UNIT - III :

Discrete-Logarithm Problem, Computational Diffie-Hellman Problem, Decisional , Diffie Hellman Problem, Elliptic-Curve Based Cryptography and Public-Key Encryption (RSA, ECC)

Random Oracle Model and Authenticated Encryption. Generic Constructions of Authenticated Encryption Schemes, Key-exchange Problem, One-way Trapdoor Functions and Cyclic Groups

UNIT - IV :

CCA -secure Public-key Hybrid Ciphers Based on Diffie-Hellman Problems and RSA assumption, Digital Signatures, Overview of TLS/SSL, Number Theory of cryptography, , Interactive Protocols, Various types of cryptosystems.

Suggested Reading:

1. Cryptography And Network Security Principles And Practice Fourth Edition, William Stallings, Pearson Education
2. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR
3. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall
4. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

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MCS 107 Lab: Data Structure Using C++

Suggested List of Experiments

- 1) Write a program to find out the largest number using function.
- 2) Write a program to find the area of circle, rectangle and triangle using function overloading.
- 3) Write a program to implement complex numbers using operator overloading and type conversion.
- 4) Write a program using class and object to print bio-data of the students.
- 5) Write a program which defines a class with constructor and destructor which will count the number of objects created and destroyed.
- 6) Write a program to implement single and multiple inheritances taking student as the sample base class.
- 7) Write a program to add two private data members using friend function.
- 8) Write a program using dynamic memory allocation to perform 2x2 matrix addition and subtraction.
- 9) Write a program to create a stack using virtual function.
- 10) Write a program that store five student records in a file.
- 11) Write a program to search an element in the array using Linear and Binary Search.
- 12) Write a program to perform the following operation in Matrix:
 1. Addition 2. Subtraction 3. Multiplication 4. Transpose
- 13) Write a program to perform the following operation on strings using string functions: 1. Addition 2. Copying 3. Reverse 4. Length of String
- 14) Write program for implementing the following sorting methods to arrange a list of integers in ascending order:
 - a) Quick sort b) Selection sort c) Insertion sort d) Merge sort
- 15) Write a program that uses stack operations to convert a given infix expression into its postfix equivalent.
- 16) Write a program to merge two sorted arrays into one sorted array.
- 17) Write a program to implement stack using array and linked list.
- 18) Write a program to implement a queue and circular queue using arrays.
- 19) Write a program to insert an element in the beginning and end of a singly linked list.
- 20) Write a program to insert an element at any position in a singly and doubly linked list.
- 21) Insert and delete a node at any position in a doubly linked list.
- 22) Write a program that uses functions to perform the following:
 - a) Create a binary search tree of integers.
 - b) Traverse the above Binary search tree non recursively in order.

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MCS 108 Lab: Programming in Python

Suggested List of Experiments

1. To write a Python program to find GCD of two numbers.
2. To write a Python Program to find the square root of a number by Newton's Method.
3. To write a Python program to find the exponentiation of a number.
4. To write a Python Program to find the maximum from a list of numbers.
5. To write a Python Program to perform Linear Search
6. To write a Python Program to perform binary search.
7. To write a Python Program to perform selection sort.
8. To write a Python Program to perform insertion sort.
9. To write a Python Program to perform Merge sort.
10. To write a Python program to find first n prime numbers.
11. To write a Python program to multiply matrices.
12. To write a Python program for command line arguments.
13. To write a Python program to find the most frequent words in a text read from a file.
14. To write a Python program to simulate elliptical orbits in Pygame.
15. To write a Python program to bouncing ball in Pygame
16. Write a python program to reverse a string.
17. Write a python program to perform following operation using lists:
 - a. append elements in the list
 - b. compare two lists
 - c. convert list to dictionary
18. Write a Program to transpose a table/pandas data frame.
19. Write a NumPy program to create a 3x3 matrix with values ranging from 2 to 10.
20. Write a python program to perform following operation on Data Frame: a. Create two different Data Frames and perform the merging operations on it. b. Create two different Data Frames and perform the grouping operations on it. c. Create two different Data Frames and perform the concatenating operations on it
21. Program to check regular expression pattern is matching with string or not in Python
22. Create a sample dataset and apply the following aggregation function on it: mean(), median() Mean and median min(), max() Minimum and maximum std(), var() Standard deviation and variance sum() Sum of all items
23. Write a python program to get row wise proportion using crosstab () function.
24. Write a python program to display a bar chart of the popularity of programming languages.
25. Write a python program to create a bar plot of scores by group and gender. Use multiple X values on the same chart for men and women.