

Department of Information Technology
Kumaun University, Nainital
M.Sc.(Information Technology)
CBCS PATTERN
Syllabus 2020-21

COURSE STRUCTURE (CBCS pattern):

BASIC SUPPORTING COURSES:

IT101	Computer Fundamentals and Object Oriented Programming with C++	5
IT104	Discrete Mathematics	5

CORE COURSES:

Code	Course Name	Credit
IT102	Database Models	5
IT103	Computer Networks and Web Technologies	5
IT201	Data Structures and Algorithms	5
IT202	Operating System	5
IT203	Advance Computer networks	5
IT204	Data Warehousing & Data Mining	5
IT301	Software Engineering	5
IT302	Artificial Intelligence	5
IT303	Programming in Java(Basic)	5
IT304	Information Security	5
IT401	Advanced Java	5
IT402	Management Information System	5
IT501	Major Project	10

ELECTIVE COURSES:

IT601	Programming in Java(Basic)	5
IT602	Information Security	5
IT603	Advanced Java	5
IT604	Management Information System	5

Semester wise course structure:

Semester I:

Basic supporting course	Computer Fundamentals and Object Oriented Programming with C++	5
IT102	Database Models	5
IT103	Computer Networks and Web Technologies	5
Basic supporting course	Discrete Mathematics	5
Practical Lab		

Semester II:

IT201	Data Structures and Algorithms	5
IT202	Operating System	5
IT203	Advance Computer networks	5
IT204	Data Warehousing & Data Mining	5
Practical Lab		

Semester III:

IT301	Software Engineering	5
IT302	Artificial Intelligence	5
	Elective 1:	5
	Elective 2:	5
Practical Lab		

Semester IV:

IT401	Elective 3:	5
IT402	Elective 4:	5
IT403	Major Project	10
Practical Lab		

Total Number of Credits =80

Pattern of examination

A. Theory: Each theory paper shall be of 03 hours and will consist of two sections, A and B. Section A: (Short answers type with reasoning); 40% of the total marks (30 marks, seven questions of six marks each, any five have to be attempted). Section B: (Long answers type); 60 % of the total marks, (45 marks, all the three questions have to be attempted, internal choice will be given. Each question carries 15 marks).

B. Internal assessment: For each theory paper, an internal assignment (in the form of class test and or assignments including classroom attendance) of 25 marks for each paper shall be conducted during each semester. The evaluated answer sheets/assignments have to be submitted to the Head of the Department/ Principal along with one copy of award list. The marks obtained have to be uploaded onto the University examination portal and the print out of the award list from portal have to be submitted to the Controller Examination.

C. Practical: The practical work of the students has to be evaluated periodically. The internal assessments (in the form of lab test, lab record, internal evaluation, assignment/home assignment and attendance) for each semester shall be conducted during the semester. In each semester, practical examination of 100 marks has to be conducted by two examiners (External and internal). The total number of students to be examined per batch should not be more than sixty. One copy of award list of the practical examination along with attendance has to be submitted to the Head of the Department/ Principal. The marks obtained have to be uploaded onto the University examination portal and the print out of the award list from portal have to be submitted to the Controller Examination.

D. Major Project: Students have to complete a project work of 10 credits advised by the faculty in the fourth semester. The project work must be submitted in the form of dissertation. It will be evaluated by two examiners (one internal and one external) for 200 marks.

Semester wise Examinations structure:

SEMESTER-I	Internal	External	Total
Computer Fund.& OOP with C++	25	75	100
Database Models	25	75	100
Computer Networks & Web Technologies	25	75	100
Discrete Mathematics	25	75	100
Total Marks:			400
Practical Examination Marks:			100
GRAND TOTAL:			500
SEMESTER –II			
Data Structures and Algorithms	25	75	100
Operating System	25	75	100
Advance Computer networks	25	75	100
Data Warehousing & Data Mining	25	75	100
Total Marks:			400
Practical Examination Marks:			100
GRAND TOTAL:			500
SEMESTER III			
Software Engineering	25	75	100
Artificial Intelligence	25	75	100
Elective 1:	25	75	100
Elective 2:	25	75	100
Total Marks:			400
Practical Examination Marks:			100
GRAND TOTAL:			500
SEMESTER –IV			
Elective 3:	25	75	100
Elective 4:	25	75	100
Major Project			200
Total Marks:			400
Practical Examination Marks:			100
GRAND TOTAL:			500

Detailed Syllabus

Basic Supporting Courses

IT101-Computer Fundamentals and Object Oriented Programming with C++

Unit-1: Number system, Binary operations -1's & 2's complements addition, subtraction, multiplication, division and other operation, fixed-point representation, floating-point representation.

Unit II: Computer software and its types, Programming languages: Machine, assembly and high level, Language translators. Necessity of an operating system, operating system structure, operating system components and services

Unit III: Need of Object Oriented Programming, Advantages of OOP, Comparison of Functional Programming and OOP Approach, Essentials of OOP: Objects, classes, Encapsulation, Data abstraction, Inheritance, Reusability, Polymorphism, Delegation, Message Communication.

Unit IV: Pointers and run time binding, dynamic memory allocation, Storage class specifiers. Classes, Member functions, Objects, Arrays of objects, Pointers and Classes, Pointers: Addresses and pointers, pointer & arrays, pointers & functions, Constructors, Destructors, Inline member functions, Friend Functions, Static member function.

Unit V: Inheritance, Single Inheritance, types of base classes, types of derivations, multiple inheritance, container classes, member access control. Functions Overloading, Operator Overloading, polymorphism, Data Conversion between objects of different classes. Virtual Function: Virtual function, pure virtual functions, Abstract classes, Friend functions.

Reference Books:

1. **The Complete reference** : Tata McGraw Hill
2. **C++ by R.Lafore** : Galgotia

IT104- Discrete Mathematics

Unit I: Sets, Relations & Functions: Property of binary relations, equivalence, compatibility, partial ordering relations, Hasse diagram, functions, inverse functions, compositions of functions, recursive functions.

Unit II: Mathematical logic: Logic operators, Truth tables, Theory of inference and deduction, mathematical calculus, predicate calculus, predicates and qualifiers.

Unit III: Basic of counting, permutation combination, circular permutation, power set, basic identities, partition and cross partition, pigeonhole principle, Pascal triangle, binomial theorem, n-Ary operation, semi group, homomorphism and isomorphism of semi groups, monoid, Addition, multiplication Modulo m & p, property and postulates of group, cosets.

Unit IV: Lattices & Boolean Algebra: Axiomatic definition of Boolean algebra as algebra as algebraic structures with two operations, basic results truth values and truth tables, the algebra of propositional functions, Boolean algebra of truth tables.

Unit V: Graph, definition, incidence and degree, order of graph, adjacency matrix, linked representation, circuit path, sub-graph, removal and addition of vertex and edge, operation of graphs complement and connect of graph, cycle, path, wheel, bipartite graph, isomorphism, forest and operation, tree, spanning tree, rooted tree, binary tree, height balance binary tree, planar graph, Euler's graph and Hamiltonian graph, digraph.

Core Courses

IT102- Database Models

Unit I: Basic concepts-Data modeling for a database, records and files, abstraction and data integration, three level architecture of DBMS, Components of DBMS, advantages and disadvantages of DBMS. Data models – Data associations, data model classification and comparison Entity relationship model (example), relational data model network data model and hierarchical model, File organization: Serial files, sequential, random, index sequential file organization, direct file.

Unit II: Relational database manipulation- SQL, Views, QBE and PL/SQL: Character Set, Arithmetic operators, Relational Operators, Variables, Common Data Types, PL/SQL Expectations, Cursors, Explicit and Implicit Cursor, PL/SQL/Tables, Triggers, Stored Procedures.

Unit III: Relational model- Relational database, relational algebra, Anomalies in a database design, universal relation, functional dependency, relational data base design.

Unit IV: Query optimization and processing, algorithm for external sorting, select and join, object and set Operations, heuristics in query optimization.

Unit V: Recovery – Reliability- transactions, recovery in centralized DBMS, Concurrency management-introduction, serializability, concurrency control, locking scheme.

IT103-Computer Networks and Web Technologies

Unit I: Introduction– Data communications, networks, internet brief history, protocols and standards. Network models- OSI model, layers in OSI mode, TCP/IP protocol suit, addressing. Data and signals- analog and digital, periodic analog signals, digital signals, transmission impairment, data rate limits, performance.

Unit II: Digital transmission, analog transmission, multiplexing, switching and transmission media, Telephone network dial up modems, digital subscriber line, cable TV networks, cable TV for data transfer.

Unit III: HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets; Introduction to Java Scripts, Objects in Java Script, and Dynamic HTML with java Script.

Unit IV: Programming in PHP: server side scripting language, HTML Embedding, comment, variables, basic data types, operators, Control Structures, Functions, passing variables between pages using URL, cookies and sessions, sending from data to the server.

Unit V: Database programming with PHP: Overview of MySQL structure Syntax, Connecting to the Database inserting, deleting and editing records to/from the database, fetching from Database, Using tables to display data, saving HTML from data to database.

Reference Books:

1. **Computer network and Protocols: by Black** : PHI
2. **Computer Network by Tanenbaum, A.S.** : PHI

IT201-Data Structures and Algorithms

Unit I: Basic concepts- Data types, Abstract Data Types, Data structure definition and applications. Algorithms Performance analysis (time complexity and space complexity basic introduction). Representation of Arrays (Linear and multi dimensional) in Memory, Insertion and Deletion in linear and 2D arrays, Pointers, passing pointers to functions, pointer to array, self referential structures.

Unit II: Linked Lists: Introduction, Representation of Linear linked Lists in Memory, Traversing a Linear Linked List, Searching item in Linear Linked List. Creation, insertion, Deletion and searching in Doubly (Two-Way) and Circular Linked List.

Unit III: Introduction to Stacks, Array and linked list Representation of Stacks, Application of Stacks, Arithmetic Expressions (Polish Notation), applications- infix to postfix conversion. Queues: Applications of queues, FIFO structure (linear queue), Priority Queues, Circular Queues, Double ended Queues, operations on Queues (Insertion, Deletion, Searching, Display, etc.)

Unit IV: Tree: Basic Terminology, Binary tree, array and linked representations of tree, traversals (in order, preorder, postorder), Binary Search Tree, Operations- Searching, Insertion and Deletion, threaded binary trees, AVL Trees, Graphs: Introduction, Basic Terminology, Graph Representations- Adjacency matrix, Adjacency lists, Adjacency multi lists, Graphs traversals- DFS and BFS. Hashing: Introduction, hash tables, hash functions, collision resolution methods.

Unit V: Searching and Sorting: Linear Search, Binary Search, Sorting: Bubble Sort, Insertion Sort, Selection Sort, Heap Sort, Radix Sort, Quick Sort and Merge sort. Design and analysis fundamental: Recursion, Divide and conquer, dynamic programming, Greedy method, Back tracking and branch-and-bound.

IT202- Operating System

Unit I: Introduction: What is an operating system, History of OS, Simple batch systems, multi programmed batch systems, time sharing systems, personnel computer systems, parallel systems, distributed systems, real time systems, Memory management: background, logical versus physical address space, swapping, contiguous allocation, paging, segmentation, segmentation with paging, Virtual memory: Demand paging, page replacement, page replacement algorithms, performance of demand paging, and allocation of frames, thrashing, and demand segmentation.

Unit II: Processes: Process concept, process scheduling, operation of process, cooperating processes, and inter process communication CPU scheduling: basic concepts, scheduling criteria, scheduling algorithms, multiple processors, scheduling, real time scheduling, algorithm evaluation Process synchronization: background, the critical – section problem, synchronization hardware, semaphores classical problem of synchronization, critical regions, and monitors.

Unit III: Deadlocks; System model, deadlock characterization, methods of handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery. Input Output Systems; I/O Hardware, application of input output interface, goals of I/O software, design of device drivers, Overview of Kernel I/O subsystem.

Unit IV: File Management: Overview of File management system, Disk Space Management, Directory Structures, protection domains, access control list, protection models.

Unit V: Case Studies: Linux OS- History, Design Principles, Kernel Modules, Process Management, Scheduling Memory Management, File Systems, Input and Output, Inter process Communication.

Reference Books:

1. Silberschatz Galvin : Operating System Concepts
2. Growley : Operating system a design approach

IT203- Advance Computer networks

Unit I: Error correction and detection-introduction block coding, linear block codes, cyclic codes, checksum, framing, flow and error control, protocols, noiseless channels, noisy channels, HDLC, Point to print protocol.

Unit II: Multiple access, Random Access, Controlled access, channelization, IEEE standards, standard Ethernet, Gigabit Ethernet, wireless LAN's –IEEE 802.11 and Bluetooth.

Unit III: Connecting devices, back bone networks, cellular telephony, and satellite networks. Frame relay and ATM. Network layer –Ipv4 and IPv6 addresses. Forwarding, unicast and multicast routing protocols.

Unit IV: Transport layer-Process to process delivery, UDP, TCP and SCTP and Congestion Control.

Unit V: Application layer- DNS, Remote logging, Electronic mail and file transfer, architecture of WWW, web documents ad HTTP.

Reference Books:

1. Tanenbaum, A.S. : Computer Network

IT204-Data Warehousing and Data mining

Unit I: Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse, System, Major issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data cleaning, Date Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Unit II: Data Warehouse and OLAP Technology for Data Mining, Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.

Unit III: Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient and Scalable Frequent item set Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining. Classification and Prediction: Issues Classification and Prediction, Classification by Decision, Tree Induction, Bayesian Classification, Rule-Based Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a classifier or a predictor, Ensemble Methods.

Unit IV: Cluster Analysis Introduction: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis- Mining Streams, Time Series and Sequence Data: Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining, Social Network Analysis and Multi relational Data Mining.

Unit V: Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web. Applications and Trends in Data Mining: Data Mining Applications, Data Mining System Products and Research Prototypes, Additional Themes on Data Mining and Social Impacts of Data Mining.

IT301- First paper-Software Engineering

Unit I: Introduction to software Engineering: The evolving role of software, changing nature of Software, legacy software, Software myths. A Generic view of process: Software engineering- A layered technology, a process framework, The capability Maturity Model Integration (CMMI), process patterns, process assessment, personal and team process models. Process Models: The waterfall model, Incremental process models, Evolutionary process models, specialized process models, The unified process.

Unit II: Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface Specification, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

Unit III: Design Engineering: Design process and Design quality, Design concepts, the design model, pattern based software design, Creating an architectural design: Software architecture, Data design, Architectural styles and patterns, Architectural Designs, assessing alternative architectural designs, mapping data flow into software architecture.

Unit IV: Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Black-Box and white-Box testing, validation testing, system testing, the art of Debugging, Product metrics: Software Quality, Frame work for product metrics, Metrics for Analysis Model, Metrics for source code, Metrics for testing, Metrics for maintenance. Metrics. Metrics for process and Products: Software Measurement, Metrics for software quality.

Unit V: Risk management: Reactive vs Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan. Quality Management: Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical software Quality assurance, Software reliability, The ISO 9000 quality standards.

Reference Books:

1. Pressman Roger S., : Tata McGraw Hill
2. Jalote, Pankaj : Narosa

IT302- Artificial Intelligence

Unit I: Definition of AI, Application of AI, Knowledge-based system, representation of Knowledge, organization, manipulation and acquisition of knowledge, introduction of prolog, variable, object, domain, clauses, recursion, basic list manipulation function, predicates, input, output, local, variable, iteration, recursion, arrays, database in prolog, rule order, goal order, cut trial, prolog query.

Unit II: Syntax, semantics of propositional logic, syntax and semantics of FOPL, conversion to clausal form inference rule, resolution principles, non-deductive inference methods, representation using rules, truth maintenance system predicate completion and circumscription, modal and temporal logics, fuzzy logic.

Unit III: Bayesian Probabilistic inference, possible word representations, Dempster- Shafer Theory, Ad-hoc methods, Heuristic reasoning methods, associative networks, frame networks, search problems, uniformed or blind search, searching And-Or graph.

Unit IV: Matching techniques, measures for matching, matching like patterns, partial matching, Fuzzy matching algorithms, indexing and retrieval techniques, integrating knowledge and memory .

Unit V: Expert system, rule based system architecture, non-productive system architecture dealing with uncertainty, knowledge acquisition and validation, knowledge system building tool.

Recommended Books:

Elective Courses:

IT601- Programming in Java (Basic)

Unit I: Java Basics: History of Java, Java Buzzwords, comments, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and Casting, enumerated types, control, flow-block scope, conditional statements, loops break and continue statements, simple java program, arrays, input and output, formatting output.

Unit II: Review of OOP concepts, encapsulation, inheritance, polymorphism, classes, objects, constructors, methods, parameter passing, static fields and methods, access control, this reference, overloading methods and constructors, recursion, garbage collection, building strings, exploring string class, Enumerations, autoboxing and Unboxing Generics. .

Unit III: Inheritance: inheritance concept, benefits of inheritance, Super classes and Sub classes, Member access rules, Inheritance hierarchies, super uses, preventing inheritance: final classes and methods, casting, polymorphism- dynamic binding, method overriding, abstract classes and methods, the Object class and its methods.

Unit IV: Interfaces: Interfaces vs. Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interface, **Inner classes:** Uses of inner classes, local inner classes, anonymous inner classes, static inner classes, examples, Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Unit V: Data structures creation and manipulation in java: Introduction to Java Collections, Overview of Java Collection frame work, Commonly used Collection classes- ArrayList, LinkedList, HashSet, HashMap, TreeMap, Collection Interfacws – Collection, Set, List, Map, Legacy Collection classes- Vector, Hashtable, Stack, Dictionary(abstract), Enumeration interface, Iteration over Collections- Iterator interface, ListIterator interface. Other Utility classes- StringTokenizer, Formatter, Random, Scanner, Observable, Using java.util.

IT602-Information Security

Unit 1: Security goals, security attacks (interruption,interception,modification and fabrication), security service (confidentiality,authentication,integrity,nonrepudiation,access control and availability) and mechanisms, A model for internetwork security, internet standards and RFCs conventional encryption principles & algorithms (DES, AES RC4), block cipher modes of operation, location of encryption devices, key distribution.

Unit 2: Public key cryptography principles, public key cryptography algorithms (RSA, RABIN, ELGAMAL, Diffie-hellman, ECC), key distribution. Approaches of message Authentication, secure hash function (SHA-512, WHIRLPOOL) and HMAC digital signatures: comparison, process- need for keys, signing the digest, service, attacks on digital signatures, Kerberos, X.509 Directory authentication service

Unit 3: Email Security: pretty good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security payload, combining security Associations and key management

Unit 4: Web Security requirement, secure socket layer (SSL) And transport layer security (TLS), Secure Electronic transaction (SET). Basic concepts of SNMP, SNMPv1 community facility and SNMPv3.

Unit 5: Intruders, Viruses and related threats, virus counter measures. Firewall Design principles, Trusted Systems, Intrusion Detection systems.

IT603- First paper-Advanced Java

UNIT I: Files: streams-byte streams, character streams, text input/ output, binary input/output, random access file operations, file management using file class, using java.io. Networking in java: Introduction, Manipulating URLs, Ex. Client/Server interactions with Stream Socket Connections, Connectionless Client/Server interaction with datagram, using java.net.

UNIT II: Exception handling: Dealing with errors, benefits of exception handling, the classifications of exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw and finally, rethrowing exceptions, exceptions specifications, built in exceptions sub class creating own exception sub classes, guide lines for proper use of exceptions. Multithreading: Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, synchronizing threads, interthread communication, thread groups.

UNIT III: GUI programming with java: The AWT class hierarchy, introduction to Swing, Swing vs. AWT, MVC architecture, Hierarchy for Swing components, Containers - JFrame, JApplet, JWindow, JDialog Light weight containers – JPanel, A simple swing application, Overview of several swing components- JButton, JToggleButton, JCheckBox, JRadioButton, JLabel, JTextfield, JTextArea, JList, JComboBox, JMenu, java's Graphics capabilities-Introduction, Graphics contexts and Graphics objects, color control, Font control, Drawing lines, rectangles and ovals, Drawing arcs, Layout management- Layout manager types-border, grid, flow, box.

UNIT IV: Event Handling: Events, Event sources, Event sources Event classes, Event sources, event classes, event listeners, relationship between event sources and Listeners, Relationship between event sources and Listeners, delegation event model, Semantic and low level events, Examples: handling a button click, handling a button click, handling Mouse and keyboard events.

UNIT V: Applets: Inheritance hierarchy for applets, differences between applets and applications, life cycle of an applets – and testing, passing parameters to applets, applet security issues.

Reference Books:

1. **The Complete reference : Tata McGraw Hill**
2. **Java E : Balaguruswami**

IT604- Management Information System

Unit I: The meaning and role of MIS : What is MIS decision support systems, systems approach, the systems view of business, MIS organization within the company, Managers view of Information systems, Contemporary Approaches to information systems, How Information Systems Impact Organizations and Business Firms.

Unit II: Conceptual system design: Define the problems, set system objectives, establish system constraints, determine information needs, determine information sources, develop alternative conceptual designs and select one, document the system concept, prepare the conceptual; design report. Organizing data and information: Datawarehouses , Datamart and datamining

Unit III: Detailed system design: Inform and involve the organization, aim of detailed design, project management of MIS detailed design, identify dominant and trade off criteria, define the subsystems, sketch the detailed operating subsystems and information flows, determine the degree of automation of each operation, inform and involve the organization again, inputs, outputs ,and processing, early system testing , software, hardware and tools, propose an organization to operate the system, document the detailed design, revisit the manager-user.

Unit IV: Implementation, evaluation and maintenance of the MIS : Plan the implementation, acquire floor space and plan space layouts, organize for implementation, develop procedures for

implementation, train the operating personnel, computer related acquisitions, develop forms for data collection and information dissemination, develop the files, test the system, cutover, document the system, evaluate the MIS, control and maintain the system.

Unit V: Pitfalls in MIS development: Fundamental weaknesses, soft spots, in planning, design problems, implementation: the TAR PIT. Introduction to E-Commerce and E-Commerce challenges. An overview of ERP, Applications of information systems to business. Security and Ethical issues of information systems.