ख़्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, Uttar Pradesh (India)
U.P. State Government University
(Recognised Under Section 2(F) & 12(B) of the UGC Act 1956 & B.Tech Approved by AICTE)

BCA Semester V
BCA 501: Software Engineering

Credit: 05, IA Marks: 25, ESE Marks: 75
Lectures: 60 Hours, Tutorial: 15 Hours

OBJECTIVES OF THE COURSE

1. Analyze and specify software requirements, and model its software design.
2. Understand the software life cycle models, and suitable model for the problem.
3. Illustrate design concepts and models and use suitable methods for software design, testing, and quality of software.

UNIT-I **Lectures: 15**

Introduction: Software Engineering Definition, Need and Importance of Software Engineering, Software Processes, Software Process Model, Software Crisis, Program vs. Software, Software Development Life Cycle (SDLC), SDLC Models such as Waterfall, RAD, Spiral, Incremental, Agile, Iterative, Prototype,
Software Metrics: Classification of Software Metrics, Types of Metrics, Size Oriented Metrics, Halstead's Software Metrics, Functional Point (FP) Analysis, Data Structure Metrics, Information Flow Metrics, Cyclomatic Complexity, Case Tools For Software Metrics

UNIT-II **Lectures: 15**

Requirements Engineering and Modeling: Requirements Engineering Process such as Feasibility Study, Requirement Elicitation and Analysis, Software Requirement Specification, Software Requirement Validation, Software Requirement Management;
Software Requirement Specifications (SRS), Data Flow Diagrams (DFD), Data Dictionaries, Entity-Relationship (E-R) Diagram.

UNIT-III **Lectures: 15**

Software Design: Objectives of Software Design, Software Design Principles, Coupling and Cohesion, Function Oriented Design, Object-Oriented Design, User Interface Design.
Software Management: Project Management, various activities in Project Management, Project Management Tools, Software Cost Estimation, Constructive Cost Estimation (COCOMO) Model.

UNIT-IV **Lectures: 15**

Software Reliability: Software Reliability Measurement Techniques, Reliability Metrics, Software Fault Tolerance
Software Testing: Types of Software Testing, Validation and Verification, approach, White Box Testing approach, Grey Box Testing, Black Box testing, Unit Testing, Integration Testing, System testing, performance testing, compatibility testing, usability testing.
Software Quality: ISO 9000 Certification, People Capability Maturity Model (PCMM), Six Sigma

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1: Understand the basic concept of software engineering, software life cycle models and study the various vital software metrics.	K1, K2
2	CO2: Learn to Analyze and specify software requirements, and model its software design.	K1, K2
3	CO3: Learn the various software designapproaches and software maintenance.	K2, K3
4	CO4: Learn about the role of softwareReliability, testing and quality assurance.	K2, K3

Suggested Readings:

1. Roger S. Pressman: Software Engineering – A practitioners' Approach. McGraw Hill
2. K.K. Aggarwal & Yogesh Singh: Software Engineering. New Age International Publishers
3. P. Jalote: Software Engineering. Narosa
4. Rajib Mall, "Software Engineering ", PHI
5. Waman S. Jawadekar,"Software Engineering: Principles and Practice", McGrawHill
6. Ian Sommerville. Software Engineering, Pearson Education (Addison Wesley),

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BCA Semester V
BCA 502: Computer Network

Credit: 05, IA Marks: 25, ESE Marks: 75
Lectures: 60 Hours, Tutorial: 15 Hours

OBJECTIVES OF THE COURSE:

1. To understand the protocol layering and physical level communication.
2. To understand the various components required to build different networks.
3. To learn the functions of network layer and the various routing protocols.
4. To familiarize the functions and protocols of the Transport layer
5. To learn how to secure the network.

UNIT-I **Lectures: 12**

Introduction to Computer Networks: Component, Features, Architecture, Types and Application area of computer network, Topologies, Transmission Modes, Models such as OSI and TCP/IP.
Physical Layer: Digital Transmission- Digital to Digital and Analog to Digital Conversion, Transmission media and its classification, Multiplexing, Switching, Switching Modes, Switching Techniques.

UNIT-II **Lectures: 12**

Data Link Layer: Services offered by the Data Link Layer, Error Detection and Correction, Data Link Controls-Line discipline (ENQ/ACK, Poll/Select), Flow Control (Stop-and-wait, Sliding window), Error Control (Stop-and-wait ARQ, Sliding Window ARQ)

UNIT-III **Lectures: 18**

Network Layer: Functions of Network Layer, Network Addressing(IPv4 and IPv6), Routing-Static, Dynamic and Default, Network Layer Protocols (ARP, RARP, ICMP, IGMP, IP), Subneting, Routing Algorithm- Adaptive and Non-adaptive, Distance Vector Routing Algorithm, Link State Routing,

UNIT-IV **Lectures: 18**

Transport Layer: Services offered by the Transport Layer, Transport Layer Protocols (TCP and UDP)
Application Layer: Functions and Offered Services of Application Layer, Network Application Architecture, Application Protocols (DNS, FTP, Telnet, SMTP, SNMP, HTTP).
Network Security: IPSec, Firewalls.

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1.To explain the basic terminologies used in networking and layered architecture of computer network. Understand the basis protocols of Physical Layer.	K1, K2
2	CO2. Illustrate different link layer terminologies like error detection-correction, flow control techniques used in network	K1, K2
3	CO3. Design network architecture, assign IP addressing and apply various routing algorithms to find shortest paths for network-layer packet delivery.	K2, K3
4	CO4. To describe and implement the essential principles of a connectionless and connection-oriented protocols used for reliable data transfer. Discuss the various services and protocols used in the Application Layer. Study the network security concepts.	K2, K3

Suggested Readings:

1. A. S. Tanenbaum, Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi, India.
2. Behrouz A. Forouzan, Data communication and Networking, 4th Edition, Mc Graw-Hill, India.
3. Data and Computer Communication by W. Stallings, Macmillan Press
4. Kurose, Ross, Computer Networking: A top-down approach, Pearson Education, India.
5. Internetworking with TCP/IP by PHI

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BCA Semester V
Elective - I: BCAE51-BCA503: Graph Theory

Credit: 05, IA Marks: 25, ESE Marks: 75
Lectures: 60 Hours, Tutorials: 15 Hours

OBJECTIVES OF THE COURSE:

1. To understand fundamentals of graph theory.
2. To study proof techniques related to various concepts in graphs.
3. To explore modern applications of graph theory

UNIT-I **Lectures: 15**

Introductions:Definitions and Application of Graphs, Types of Graphs, Basic Properties of Graph, Graph Representations, Set Operations on Graphs: Union, Sum, Complement, Difference, Cartesian Product, Composition, and Fusion. Sub-graphs, Isomorphic graphs, Degree of a vertex, Directed walks, paths and cycles, Connectivity in digraphs, Eulerian and Hamilton digraphs

UNIT-II **Lectures: 15**

Connected Graphs and Shortest paths: Connected graphs, Distance, Cut-vertices and cut-edges, Blocks, Connectivity, Weighted graphs, and shortest paths, Weighted graphs, Djkstra's shortest path algorithm, Floyd-Warshall's shortest path algorithm.

UNIT-III **Lectures: 15**

Trees: Properties, Pendant Vertices, Distance and Canters in a tree, Rooted and Binary Trees, Counting Trees, Spanning Trees and Fundamental Circuits, Number of Spanning Trees.
Planar and Dual Graphs: Combinatorial Vs Geometric Graphs, Planar Graphs, Kuratwoski Graphs, Theorems, Detection of Planarity, Geometric and Combinatorial Dual, Thickness and Crossings.

UNIT-IV **Lectures: 15**

Coloring, Covering and Partitioning: Basic definitions, Cliques and chromatic number, Chromatic Polynomials, Mycielski's theorem, Greedy coloring algorithm, Coloring of chordal graphs, Brooks theorem, Edge Colorings, Matchings, Coverings, The four-color conjecture and five-color theorem.

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1.Students will achieve command of the fundamental definitions and concepts of graph theory.	K1, K2
2	CO2. To Understand the properties, theorems and be able to prove theorems.	K2, K3
3	CO3.Apply suitable tree model and algorithm for solving applications.	K2, K3

4	CO4.Able to demonstrate their knowledge of algorithms by solving concrete problems.	K2, K3

Suggested Readings:

1. NarsinghDeo, “Graph theory with applications to engineering and computer science”, Prentice-Hall of India Pvt.Ltd,
2. L.R.Foulds, "Graph Theory Applications", Springer ,.
3. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication.
4. West, D. B., ―Introduction to Graph Theory‖, Pearson Education .
5. Kenneth H.Rosen, "Discrete Mathematics and Its Applications", McGrawHill.

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BCA Semester V
Elective - I: BCAE52-BCA503: Data Warehousing and Data Mining
Credit: 05, IA Marks: 25, ESE Marks: 75
Lectures: 60 Hours, Tutorials: 15 Hours

OBJECTIVES OF THE COURSE:

1. To understand and technologies for storing large databases.
2. To understand the retrieval of useful information through data mining techniques.
3. To explore modern applications in emerging computing.

UNIT-I **Lectures: 15**

Introduction to Data Warehouse: Definition, Goal and Benefits of Data Warehouse, Data Warehouse Components, Difference between Database and Data Warehouse, Multi-Dimensional Data Model, Data Cubes, Schema, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Mart, Query Facility, OLAP operations, OLAP Servers, OLAP vs OLTP, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.
Data Mining: Overview, Motivation & Evolution, Functionalities, KDD, Architecture, Applications, Classification, Issues.

UNIT-II **Lectures: 15**

Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept hierarchy generation, Online Data Storage.
Data Mining Primitives, Data Mining Query Languages, Designing Graphical User Interfaces Based on a Data Mining Query Language.

UNIT-III **Lectures: 15**

Mining Association Rules in Large Databases: Association Rule Mining, Mining Single-Dimensional Boolean Association Rules fromTransactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

UNIT-IV **Lectures: 15**

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. To Understand warehousing architectures and tools for systematically organizing large database and use their data to make strategic decisions. To Understand KDD	K1, K2

	process for finding interesting pattern from warehouse.	
2	CO2.Apply suitable pre-processing and visualization techniques for data analysis	K2, K3
3	CO3Apply frequent pattern and association rule mining techniques for data analysis and visualization to real world data	K2, K3
4	CO4. Apply appropriate classification and clustering techniques for data analysis visualization to real world data	K2, K3

Suggested Readings:

1. Jiawei Han and MichelineKamber, Data Mining Concepts and Techniques‖, Third Edition, Elsevier.
2. Alex Berson and Stephen J.Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition.
3. M. H. Dunham,Data Mining: Introductory and Advanced Topics, Pearson Education.
4. Arun K Pujari,Data Mining Techniques, University PressBuilding the DataWarehouse-W. H. Inmon, Wiley Dreamtech India Pvt. Ltd.
5. Ian H.Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.
6. Margaret H Dunham, Data Mining: Introductory and Advanced Topics, Pearson EducationIndia
7. Sam Anahory & Dennis Murray,Data Warehousing in the Real World, Pearson EducationAsia.
8. Paulraj Ponnaiah, Data Warehousing Fundamentals, Wiley Student Edition

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BCA Semester V
Elective - I: BCAE53-BCA503: Software Project Management

Credit: 05, IA Marks: 25, ESE Marks: 75
Lectures: 60 Hours, Tutorials: 15 Hours

OBJECTIVES OF THE COURSE:

1. To understand the Software Project Planning and Evaluation techniques.
2. To plan and manage projects at each stage of the software development life cycle (SDLC).
3. To learn about the activity planning and risk management principles.
4. To manage software projects and control software deliverables.
5. To develop skills to manage the various phases involved in project management and people management.
6. To deliver successful software projects that support organization's strategic goals.

UNIT-I **Lectures: 15**

Introduction and Software Project Planning: Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods (COSMIC Full function points), Estimation models (COCOMO II - a Parametric Productivity Model), Decision process.

UNIT-II **Lectures: 15**

Project Organization and Scheduling Project Elements: Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts. (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.

UNIT-III **Lectures: 15**

Project Monitoring and Control: Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.

UNIT-IV **Lectures: 15**

Software Quality Assurance and Testing Objectives: Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Cleanroom process.

Project Management and Project Management Tools Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1 To Understand Project Management principles while developing software.	K1, K2
2	CO2. To Obtain adequate knowledge about software process models and software effort estimation techniques.	K1, K2
3	CO3. To Gain extensive knowledge about the basic project management concepts, framework and the process models.	K1, K2
4	CO4. To Estimate the risks involved in various project activities. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.	K2, K3

Suggested Readings:

1. 1. M. Cotterell, Software Project Management, Tata McGraw-Hill Publication.
2. Royce, Software Project Management, Pearson Education
3. Kieron Conway, Software Project Management, Dreamtech Press
4. S. A. Kelkar, Software Project Management, PHI Publication.
5. Harold R. Kerzner, Project Mangment "A Systems Approach to Planning, Scheduling, and Controlling" Wiley.
6. Mohapatra, Software Project Management, Cengage Learning.
7. P.K. Agarwal, SAM R., Software Project Management, Khanna Publishing House.

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BCA Semester V
BCA 504: Minor Project

Credit: 5, IA Marks: 25, ESE Marks: 75

OBJECTIVES OF THE COURSE:

- To help students develop openness to new ideas in computer science, develop the ability to draw reasonable inferences from observations and learn to formulate and solve new computer science problems using analytical and problem-solving skills;
- To help students develop the ability to synthesize and integrate information and ideas, develop the ability to think creatively, develop the ability to think holistically and develop the ability to distinguish between facts and opinion;
- To help students acquire the necessary competences to build a real-life software system by completing different software life cycle phases (like, specification, architecture, design, implementation, validation, documentation, etc.

BCA Semester V
BCA 505: Industrial Training

Credit: 0, IA Marks: 25, ESE Marks: 75

After completing the fourth & fifth semester of the BCA Programme, each student shall undertake an Industrial Training (Qualifying). A student shall submit a written structured report on the basis of work done within four weeks of the commencement of the fifth/sixth semester.