VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

JNANA SAGARA CAMPUS, BALLARI-583105

Department of Studies in Computer Science

V Semester Syllabus

Bachelor of Computer Application (B.C.A)

With Effect from the Academic Year 2023-24 onwards

Approved in BOS dated on 30.08.2023

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Curriculum Structure

Semester	Course No.	Theory/Practical	Credits	Paper Title	Marks	
					S.A.	I.A.
V	DSC13	Theory	4	Design & Analysis of Algorithms	60	40
	DSC13-Lab	Practical	2	Design & Analysis of Algorithms Lab	25	25
	DSC14	Theory	4	Statistical Computing and R Programming	60	40
	DSC14-Lab	Practical	2	R Programming Lab	25	25
	DSC15	Theory	4	Software Engineering	60	40
	DSE-E1	Theory	3	A. Cloud Computing B. Business Intelligence	60	40
	Voc-1	Theory	3	Digital Marketing	60	40
	SEC-4	Theory/Practical	3	Cyber Security	60	40
VI	DSC16	Theory	4	Artificial Intelligence and Applications	60	40
	DSC16-Lab	Practical	2	Artificial Intelligence and Application Lab	25	25
	DSC17	Theory	4	PHP and MySQL	60	40
	DSC17-Lab	Practical	2	PHP and MySQL Lab	25	25
	DSE-E2	Theory	3	A. Fundamentals of Data Science B. Mobile Application Development	60	40
	Voc-2	Theory	3	Web Content Management System	60	40
			6	Project	75	75

Syllabus for BCA

Semester:V

Course Title: Design and Analysis of Algorithm	**Course code: 21BCA5C13DAL**
Total Contact Hours: 52	**Course Credits: 04**
Formative Assessment Marks: 40	**Duration of SEE/Exam: 02 Hours**
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- CO1. Understand the fundamental concepts of algorithms and their complexity, including time and space complexity, worst-case and average-case analysis, and Big-O notation. BL (L1, L2).
- CO2. Design algorithms for solving various types of problems, such as Sorting, Searching, Graph traversal, Decrease-and-Conquer, Divide-and-Conquer and Greedy Techniques. BL (L1, L2, L3).
- CO3. Analyze and compare the time and space complexity of algorithms with other algorithmic techniques. BL (L1, L2,L3,L4)
- CO4. Evaluate the performance of Sorting, Searching, Graph traversal, Decrease-and-Conquer, Divide-and-Conquer and Greedy Techniques using empirical testing and benchmarking, and identify their limitations and potential improvements. BL (L1, L2, L3, L4).
- CO5. Apply various algorithm design to real-world problems and evaluate their effectiveness and efficiency in solving them. BL (L1, L2, L3).
  Note: Blooms Level (BL): L1=Remember, L2=Understand, L3=Apply, L4=Analyze, L5= Evaluate, L6= Create.

DSC13: Design and Analysis of Algorithm

Unit	Description	Hours
1	**Introduction:** What is an Algorithm? Fundamentals of Algorithmic problem solving, Fundamentals of the Analysis of Algorithm Efficiency, Analysis Framework, Measuring the input size, Units for measuring Running time, Orders of Growth, Worst-case, Best-case and Average-case efficiencies.	10
2	**Asymptotic Notations** and Basic Efficiency classes, Informal Introduction, O-notation, Ω-notation, θ-notation, mathematical analysis of non-recursive algorithms, mathematical analysis of recursive algorithms.	10
3	**Brute Force & Exhaustive Search:** Introduction to Brute Force approach, Selection Sort and Bubble Sort, Sequential search, Exhaustive Search-Travelling Salesman Problem and Knapsack Problem, Depth First Search, Breadth First Search	11

4	**Decrease-and-Conquer:** Introduction, Insertion Sort, Topological Sorting **Divide-and-Conquer:** Introduction, Merge Sort, Quick Sort, Binary Search, Binary Tree traversals and related properties.	11
5	**Greedy Technique:** Introduction, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Lower-Bound Arguments, Decision Trees, P Problems, NP Problems, NP- Complete Problems, Challenges of Numerical Algorithms.	10

References:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009, Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
4. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).
5. Weblinks and Video Lectures (e-Resources)

   http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html

   https://nptel.ac.in/courses/106/101/106101060/

   http://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html

   http://cse01-iiith.vlabs.ac.in/

Course Title: Design and Analysis of Algorithm Lab	**Course code: DSC13 Lab**
Total Contact Hours: 52	**Course Credits: 02**
Formative Assessment Marks: 25	**Duration of SEE/Exam: 03 Hours**
Summative Assessment Marks: 25	

Practicals:

1. Write a program to sort a list of N elements using Selection Sort Technique.
2. Write a program to perform Travelling Salesman Problem
3. Write program to implement Dynamic Programming algorithm for the 0/1 Knapsack problem.
4. Write a program to perform Knapsack Problem using Greedy Solution
5. Write program to implement the DFS and BFS algorithm for a graph.
6. Write a program to find minimum and maximum value in an array using divide and conquer.
7. Write a test program to implement Divide and Conquer Strategy. Ex: Quick sort algorithm for sorting list of integers in ascending order.
8. Write a program to implement Merge sort algorithm for sorting a list of integers in ascending order.
9. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort.
10. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort.
11. Write C program that accepts the vertices and edges for a graph and stores it as an adjacency matrix.
12. Implement function to print In-Degree, Out-Degree and to display that adjacency matrix.
13. Write program to implement backtracking algorithm for solving problems like N queens.
14. Write a program to implement the backtracking algorithm for the sum of subsets problem
15. Write program to implement greedy algorithm for job sequencing with deadlines.
16. Write program to implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem.
17. Write a program that implements Prim's algorithm to generate minimum cost spanning Tree.
18. Write a program that implements Kruskal's algorithm to generate minimum cost spanning tree.

Course Title: Statistical Computing & R Programming	**Course code: 21BCA5C14SPL**

Total Contact Hours: 52	**Course Credits: 04**
Formative Assessment Marks: 40	**Duration of SEE/Exam: 02 Hours**
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- CO1. Explore fundamentals of statistical analysis in R environment.
- CO2. Describe key terminologies, concepts and techniques employed in Statistical Analysis.
- CO3. Define Calculate, Implement Probability and Probability Distributions to solve a wide variety of problems.
- CO4. Conduct and interpret a variety of Hypothesis Tests to aid Decision Making.
- CO5. Understand, Analyze, and Interpret Correlation Probability and Regression to analyze the underlying relationships between different variables.

DSC14: Statistical Computing & R Programming

Unit	Description	Hours
1	Introduction of the language, numeric, arithmetic, assignment, and vectors, Matrices and Arrays, Non-numeric Values, Lists and Data Frames, Special Values, Classes, and Coercion, Basic Plotting.	10
2	Reading and writing files, Programming, Calling Functions, Conditions and Loops: stand- alone statement with illustrations in exercise 10.1,stacking statements, coding loops, Writing Functions, Exceptions, Timings, and Visibility.	10
3	Statistics And Probability, basic data visualization, probability, common probability distributions: common probability mass functions, bernoulli, binomial, poisson distributions, common probability density functions, uniform, normal, student's t-distribution.	11
4	Statistical testing and modelling, sampling distributions, hypothesis testing, components of hypothesis test, testing means, testing proportions, testing categorical variables, errors and power, Analysis of variance.	10
5	Simple linear regression, multiple linear regression, linear model selection and diagnostics. Advanced graphics: plot customization, plotting regions and margins, point and click coordinate interaction, customizing traditional R plots, specialized text and label notation. Defining colors and plotting in higher dimensions, representing and using color, 3D scatter plots.	11

References:

1. Tilman M. Davies, "The book of R: A first course in programming and statistics", San Francisco, 2016.
2. Vishwas R. Pawgi, "Statistical computing using R software", Nirali prakashan publisher, e1 edition, 2022.
3. https://www.youtube.com/watch?v=KlsYCECWEWE
4. https://www.geeksforgeeks.org/r-tutorial/
5. https://www.tutorialspoint.com/r/index.htm

Course Title: R Programming Lab	**Course code: 21BCA5C14SPP**
Total Contact Hours: 52	**Course Credits: 02**

Formative Assessment Marks: 25	**Duration of SEE/Exam: 03 Hours**
Summative Assessment Marks: 25	

Practicals:

1. Write an R program for different types of data structures in R.
2. Write an R program that includes variables, constants, data types.
3. Write an R program that include different operators, control structures, default values for arguments, returning complex objects.
4. Write an R program for quick sort implementation, binary search tree.
5. Write an R program for calculating cumulative sums and products minima maxima and calculus.
6. Write an R program for finding stationary distribution of markanov chains.
7. Write an R program that includes linear algebra operations on vectors and matrices.
8. Write a R program for any visual representation of an object with creating graphs using graphic functions: Plot(), Hist(), Linechart(), Pie(), Boxplot(), Scatter plots().
9. Write an R program for with any dataset containing data frame objects, indexing and subsetting data frames and employ manipulating and analyzing data.
10. Write a program to create any application of Linear Regression in multivariate context for predictive purpose.

Course Title: Software Engineering	**Course code: 21BCA5C15SEL**
Total Contact Hours: 52	**Course Credits: 04**

Formative Assessment Marks: 40	**Duration of SEE/Exam: 02 Hours**
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- CO1. How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment.
- CO2. An ability to work in one or more significant application domains.
- CO3. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software.
- CO4. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle.
- CO5. Demonstrate an ability to use the techniques and tools necessary for engineering practice.

DSC15: Software Engineering

Unit	Description	Hours
1	**OVERVIEW:** Introduction, Software engineering ethics, Software process models, Process activities, Coping with change, Agile software development: Agile methods, Plan- driven and agile development.	10
2	**REQUIREMENTS ENGINEERING:** Functional and non-functional requirements, Software requirements document, Requirement's specification, Requirements engineering processes, Requirement's elicitation and analysis, Requirement's validation, Requirements management.	10
3	**SYSTEM MODELING:** Context models, Interaction models- Use case modeling, Sequence diagrams, Structural models- Class diagrams, Generalization, Aggregation, Behavioral models-Data-driven modeling, Event-driven modeling; Model-driven engineering.	10
4	**ARCHITECTURALDESIGN:** Architectural design decisions, Architectural views, Architectural patterns- Layered architecture, Repository architecture, Client–server architecture Pipe and filter architecture. **DESIGN AND IMPLEMENTATION:** Object-oriented design using the UML- System context and interactions, Architectural design, Object class identification, Design models, Interface specification, Design patterns, Implementation issues.	12
5	**SOFTWARE TESTING:** Development testing-Unit testing, Choosing unit test cases, Component testing, System testing. Test-driven development, Release testing, User testing-Alpha, Beta, Acceptance testing.	10

References:

1. Ian Somerville, "SoftwareEngineering"8thEdition, Pearson Education, 2009.
2. Waman S Jawadekar, "Software Engineering Principles and Practice", Tata McGraw Hill, 2004.
3. Roger S. Pressman, "A Practitioners Approach", 7th Edition, McGraw-Hill, 2007.
4. P Jalote, "An Integrated Approach to software Engineering", Narosa Publication.

Course Title: Cloud Computing	**Course code: 21BCA5E1CC1**
Total Contact Hours: 42	**Course Credits: 03**

Formative Assessment Marks: 40	**Duration of SEE/Exam: 02 Hours**
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- CO1.Explain the core concepts of the cloud computing paradigm such as how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
- CO2.Apply the fundamental concepts in data centers to understand the trade-offs in power, efficiency and cost.
- CO3.Identify resource management fundamentals like resource abstraction, sharing and sand boxing and outline their role in managing infrastructure in cloud computing.
- CO4. Analyze various cloud programming models and apply them to solve problems on the cloud.

DSE-E1(A): Cloud Computing

Unit	Description	Hours
1	**Introduction:** Different Computing Paradigms Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing etc., Comparison of various Computing Technologies; Cloud Computing Basics- What is Cloud Computing? History, Characteristic Features, Advantages and Disadvantages, and Applications of Cloud Computing; Trends in Cloud Computing; Leading Cloud Platform Service Providers.	8
2	**Cloud Architecture:** Cloud Service Models- Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), Comparison of different Service Models; Cloud Deployment Models-Public Cloud; Private Cloud, Hybrid Cloud, Community Cloud; Cloud Computing Architecture-Layered Architecture of Cloud. Virtualization- Definition, Features of Virtualization; Types of Virtualizations- Hardware Virtualization, Server Virtualization, Application Virtualization, Storage Virtualization, Operating System Virtualization; Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples- X en: Para virtualization, VMware: Full Virtualization, Microsoft Hyper-V.	10
3	**Cloud Application Programming and the Aneka Platform:** Aneka Cloud Application Platform- Framework Overview, Anatomy of the Aneka Container; Building Aneka Clouds(Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode); Cloud Programming and Management- Aneka SDK(Application Model and Service Model); Management Tools (Infrastructure, Platform and Application management).	8
4	**Cloud Platforms in Industry:** Amazon Web Services- Compute Services, Storage Services, Communication Services, Additional Services; Google App Engine- Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations; Microsoft Azure Azure Core Concepts (Compute,	8

	Storage, Core Infrastructure and Other Services), SQL Azure, Windows Azure Platform Appliance.	
5	**Cloud Applications**: Scientific Applications- Healthcare (ECG Analysis in the Cloud) Biology (Protein Structure Prediction and Gene Expression Data Analysis for Cancer Diagnosis), Geo science (Satellite Image Processing); Business and Consumer Applications- CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.	8

References:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi: "Mastering Cloud Computing Foundations and Applications Programming", Elsevier, 2013.
2. Barrie Sosinsky: "Cloud Computing Bible", Wiley-India, 2010
3. K Chandrashekaran: "Essentials of Cloud Computing", CRC Press, 2015.
4. Derrick Rountree, Ileana Castrillo: "The Basics of Cloud Computing", Elsevier, 2014.

Course Title: Business Intelligence	**Course code: 21BCA5E1BI1**
Total Contact Hours: 42	**Course Credits: 03**

Formative Assessment Marks: 40	**Duration of SEE/Exam: 02 Hours**
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- CO1. Describe the Decision Support systems and Business Intelligence framework.
- CO2. Explore knowledge management explain its activities, approaches and its implementation.
- CO3. Describe business intelligence, analytics, and decision support systems

DSE-E1(B): Business Intelligence

Unit	Description	Hours
1	Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics.	8
2	Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.	8
3	Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process,, Sentiment Analysis, Speech Analytics.	10
4	Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets, Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pair wise Comparisons.	8
5	Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, and Development of Expert Systems.	8

References:

1. Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, and Development of Expert Systems.
2. Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November 2017 by Edward Miz.

Course Title: Digital Marketing	**Course code: Voc-1**
Total Contact Hours: 42	**Course Credits: 03**

Formative Assessment Marks: 40	**Duration of SEE/Exam: 02 Hours**
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- CO1. Understand the fundamental concepts and principles of digital marketing.
- CO2. Develop practical skills to implement various digital marketing strategies and techniques.
- CO3. Analyze and evaluate the effectiveness of digital marketing campaigns.
- CO4. Apply critical thinking and problem-solving skills to real-world digital marketing scenarios.
- CO5. Create comprehensive digital marketing plans and strategies.

Voc-1: Digital Marketing

Unit	Description	Hours
1	**Introduction to Digital Marketing:** Overview of digital marketing, Evolution of digital marketing, Importance and benefits of digital marketing, Digital marketing channels and platforms. **Digital Marketing Strategy and Planning:** Developing a digital marketing strategy, Setting goals and objectives, Budgeting and resource allocation.	8
2	Campaign planning and execution, Monitoring and adjusting digital marketing campaigns **Social Media Marketing:** Overview of social media marketing, Social media platforms and their features, Creating and optimizing social media profiles, Social media content strategy, Social media advertising and analytics.	8
3	**Email Marketing:** Introduction to email marketing, Building an email list, Creating effective email campaigns, Email automation and segmentation, Email marketing metrics and analytics **Content Marketing:** Understanding content marketing, Content strategy and planning.	8
4	Content creation and distribution, Content promotion and amplification, Content marketing metrics and analytics. **Mobile Marketing:** Mobile marketing overview, Mobile advertising strategies, Mobile app marketing, Location-based marketing, Mobile marketing analytics	8
5	**Analytics and Reporting:** Importance of analytics in digital marketing, Setting up web analytics tools(e.g., Google Analytics), Tracking and measuring key performance indicators (KPIs), Conversion tracking and optimization, Reporting and data visualization	10

References:

1. "Digital Marketing Strategy: An Integrated Approach to Online Marketing" by Simon Kingsnorth.
2. "Email Marketing Rules: How to Wear a White Hat, Shoot Straight, and Win Hearts" by Chad S. White
3. "Content Inc.: How Entrepreneurs Use Content to Build Massive Audiences and Create Radically Successful Businesses" by Joe Pulizzi
4. "Mobile Marketing: How Mobile Technology is Revolutionizing Marketing,

Communications and Advertising" by Daniel Rowles
5. "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity" by Avinash Kaushik