



ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ DAVANGERE UNIVERSITY

Syllabus for Bachelor of Computer Application (BCA)


(V & VI Semesters)

[According to NEP-2020 Policy]

W.E.F 2023-24 and onwards

**DEPARTMENT STUDIES IN COMPUTER SCIENCE,
DAVANGERE UNIVERSITY, DAVANGERE-07**


BOS Chairman
Dept. of Computer Science
Davangere University
Shivagangotri, Davangere


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1. What is the purpose of the study?
 2. What are the research questions?
 3. What is the significance of the study?
 4. What are the limitations of the study?

CURRICULUM STRUCTURE

Program: BCA

Semester	Course No.	Theory/Practical	Credits	Hrs./Week	Paper Title	Marks	
						S.A.	I.A.
V	DSC13	Theory	4	4	Design & Analysis of Algorithms	60	40
	DSC13-Lab	Practical	2	4	Design & Analysis of Algorithms Lab	30	20
	DSC14	Theory	4	4	Statistical Computing and R Programming	60	40
	DSC14-Lab	Practical	2	4	R Programming Lab	30	20
	DSC15	Theory	4	4	Software Engineering	60	40
	DSE-E1	Theory	3	3	A. Cloud Computing B. Business Intelligence	60	40
	Voc-1	Theory	3	3	Digital Marketing	60	40
	SEC-4	Theory	3	4	Employability Skills/ Cyber Security	30	20
VI	DSC16	Theory	4	4	Artificial Intelligence and Applications	60	40
	DSC16-Lab	Practical	2	4	Artificial Intelligence and Applications Lab	60	40
	DSC17	Theory	4	4	PHP and MySQL	60	40
	DSC17-Lab	Practical	2	4	PHP and MySQL Lab	30	20
	DSC18	Theory	4	4	Data Warehouse And Data Mining	60	40
	DSE-E2	Theory	3	3	A. Fundamentals of Data Science B. Mobile Application Development	60	40
	Voc-2	Theory	3	3	Web Content Management System	60	40
	INT-1	Internship	2	2	Internship	30	20

Total Credits of 5th and 6th Semesters: 49(25+24)

Total Marks of 5th and 6th Semesters: 1300

Program Name	BCA	Semester	V
Course Title	Design and Analysis of Algorithm (Theory)		
Course Code:	DSC13	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student 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)

Contents	52 Hrs
UNIT-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
UNIT-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
UNIT-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
UNIT-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
UNIT-5 Greedy Technique: Introduction, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Introduction to Lower-Bound Arguments, Decision Trees, Introduction to P, NP, NP-Complete Problems, Challenges of Numerical Algorithms.	10

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

Course Title	Design and Analysis of Algorithms Laboratory (Practical)	Practical Credits	02
Course Code	DSC5-Lab	Contact Hours	04 Hours/Week
Formative Assessment	20 Marks	Summative Assessment	30 Marks

Practical Content

PART-A.

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Implement a Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted. The elements can be read from a file or can be generated using the random number generator.
3. Write a program to sort a list of N elements using Selection Sort Technique.
4. Write a program to perform Travelling Salesman Problem
5. Write program to implement Dynamic Programming algorithm for the 0/1 Knapsack problem.
6. Write a program to perform Knapsack Problem using Greedy Solution
7. Write program to implement the DFS and BFS algorithm for a graph.
8. Write a program to find minimum and maximum value in an array using divide and conquer.
9. Write a test program to implement Divide and Conquer Strategy. Eg: Quick sort algorithm for sorting list of integers in ascending order.
10. Write a program to implement Merge sort algorithm for sorting a list of integers in ascending order.

PART-B.

1. Write a program to 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.
2. Write a program to 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.
3. Write C program that accepts the vertices and edges for a graph and stores it as an adjacency matrix.
4. Write a program to Implement a function to print In-Degree, Out-Degree and to display that adjacency matrix.
5. Write program to implement backtracking algorithm for solving problems like N queens.
6. Write a program to implement the backtracking algorithm for the sum of subsets problem
7. Write program to implement greedy algorithm for job sequencing with deadlines.
8. Write program to implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem.
9. Write a program that implements Prim's algorithm to generate minimum cost spanning Tree.
10. Write a program that implements Kruskal's algorithm to generate minimum cost spanning tree.

Note: A minimum of 08 Programs should be done in each Part.

Formative Assessment for Practical	
Assessment Occasion/ type	Marks
Lab Records	5
Attendance	5
Internal Assessment Test	10
Total	20 Marks
<i>Formative Assessment as per guidelines.</i>	

Pedagogy: Demonstration, Hands-on, Simulation

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/ http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms

Program Name	BCA	Semester	V
Course Title	Statistical Computing & R Programming (Theory)		
Course Code:	DSC14	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student 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, Analyse, and Interpret Correlation Probability and Regression to analyse the underlying relationships between different variables.

Contents	52 Hrs
UNIT-1: Introduction of the R language, numeric, arithmetic, assignment, and vectors, Matrices and Arrays, Non-numeric Values, Lists and Data Frames, Special Values, Classes, and Coercion, Basic Plotting.	10
UNIT-2: Reading and writing files, Programming, Calling Functions, Conditions and Loops: stand-alone statement with illustrations in exercise 10.1,stacking statements, coding loops, WritingFunctions, Exceptions, Timings, and Visibility.	10
UNIT-3: Statistics And Probability, basic data visualisation, probability, common probability distributions: common probability mass functions, bernoulli, binomial, poisson distributions, common probability density functions, uniform, normal, student's t-distribution.	11
UNIT-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
UNIT-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

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-

Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

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 https://www.geeksforgeeks.org/r-tutorial/ https://www.tutorialspoint.com/r/index.htm

Program Name	BCA	Semester	V
Course Title	R Programming Lab		
Course Code:	DSC14 Lab	No. of Credits	02
Contact hours	04 Hours per week	Duration of SEA/Exam	2 hours
Formative Assessment Marks	20	Summative Assessment Marks	30

Overview

The following program problematic comprises of R programming basics and application of several Statistical Techniques using it. The module aims to provide exposure in terms of Statistical Analysis, Hypothesis Testing, Regression and Correlation using R programming language.

Learning Objectives

The objective of this Laboratory to make students exercise the fundamentals of statistical analysis in R environment. They would be able to analysis data for the purpose of exploration using Descriptive and Inferential Statistics. Students will understand Probability and Sampling Distributions and learn the creative application of Linear Regression in multivariate context for predictive purpose.

Course Outcomes:

- Install Code and Use R Programming Language in R Studio IDE to perform basic tasks on Vectors, Matrices and Data frames. Explore fundamentals of statistical analysis in R environment.
- Describe key terminologies, concepts and techniques employed in Statistical Analysis.
- Define Calculate, Implement Probability and Probability Distributions to solve a wide variety of problems.
- Conduct and interpret a variety of Hypothesis Tests to aid Decision Making.
- Understand, Analyze, and Interpret Correlation Probability and Regression to analyze the underlying relationships between different variables.

PART-A

1. Write a R program for different types of data structures in R.
2. Write a R program that include variables, constants, data types.
3. Write a R program that include different operators, control structures, default values for arguments, returning complex objects.
4. Write a R program for quick sort implementation, binary search tree.
5. Write a R program for calculating cumulative sums, and products minima maxima and calculus.
6. Write a R program for finding stationary distribution of markanov chains.
7. Write a R program that include 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(),Scatterplots().
9. Write a 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.

PART-B:

1. Write a R Program to Find the Factorial of a Number
2. Write a Convert Decimal into Binary using Recursion in R
3. Write a R Program to check Armstrong Number
4. Write a R Program to Add Two Vectors
5. Write a Fibonacci Sequence Using Recursion in R
6. Write a R Program to Find H.C.F. or G.C.D
7. Write a R Program to Check for Leap Year
8. Write a R Program to Find 3rd Minimum and 3rd Maximum of Numbers.
9. Write a R Multiplication Table
10. R Program to Check Prime Number

Note: A minimum of 08 Programs should be done in each Part.

Formative Assessment for Practical	
Assessment Occasion/ type	Marks
Lab Records	5
Attendance	5
Internal Assessment Test	10
Total	20 Marks
<i>Formative Assessment as per guidelines.</i>	

Program Name	BCA	Semester	V
Course Title	Software Engineering (Theory)		
Course Code:	DSC15	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student 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.

Contents	52 Hrs
UNIT-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
UNIT-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; Requirementsmanagement.	10
UNIT-3:SYSTEM MODELING: Context models; Interaction models- Use case modeling, Sequencediagrams; Structural models- Class diagrams, Generalization, Aggregation; Behavioral models- Data-driven modeling, Event-driven modeling; Model-driven engineering.	10
UNIT-4:ARCHITECTURAL DESIGN: 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
UNIT-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

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

Text Books:

1 | Ian Somerville, —Software EngineeringI 8th Edition, Pearson Education, 2009.

References Books:

1 | Waman S Jawadekar, —Software Engineering Principles and Practicel, Tata McGrawHill, 2004.

2 | Roger S. Pressman, —A Practitioners ApproachI, 7th Edition, McGraw-Hill, 2007.

3 | P Jalote, —An Integrated Approach to software EngineeringI, Narosa Publication.

Program Name	B.C.A.	Semester	V
Course Title	Cloud Computing (Theory)		
Course Code:	DSE-E1	No. of Credits	03
Contact hours	42 Hours(3hrs/week)	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student 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 centres to understand the trade-offs in power, efficiency and cost.
CO3	Identify resource management fundamentals like resource abstraction, sharing and sandboxing 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.

Contents		42 Hrs
UNIT-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	
UNIT-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- Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V.	10	
UNIT-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	
UNIT-4:Cloud Platforms in Industry: Amazon Web Services- Compute Services, Storage Services, Communication Services, Additional Services; Google AppEngine- Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations; Microsoft Azure- Azure Core Concepts (Compute, Storage, Core Infrastructure and Other Services), SQL Azure, Windows Azure Platform Appliance.	8	
UNIT-5:Cloud Applications: Scientific Applications- Healthcare (ECG Analysis in the Cloud) Biology (Protein Structure Prediction and Gene Expression Data Analysis for Cancer	8	

Diagnosis); Geoscience (Satellite Image Processing); Business and Consumer Applications- CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

Text Books:

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

Program Name	BCA	Semester	V
Course Title	Business Intelligence (Theory)		
Course Code:	DSE-E1	No. of Credits	03
Contact hours	42 Hours(3hrs/week)	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student 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

Contents	42 Hrs
UNIT-1: Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for BusinessIntelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics	8
UNIT-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
UNIT-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
UNIT-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 Pairwise Comparisons.	8
UNIT-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

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped

Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

Text Books:

1	Ramesh Sharda, Dursun Delen, Efraim Turban, J.E. Aronson, Ting-Peng Liang, David King, —Business Intelligence and Analytics: System for Decision Support I, 10th Edition, Pearson Global Edition. Reference books
2	Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November 2017 by Edward Miz

Additional Reading:

1	https://shorturl.at/iuAT0
2	https://www.coursera.org/courses?query=business 20intelligence

Program Name	B.C.A	Semester	V
Course Title	Digital Marketing (Theory)		
Course Code:	Voc-1	No. of Credits	03
Contact hours	42 Hours(3hrs/week)	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s):

- Basic Knowledge of internet and internet browsing.
- Experimental and Analytical mindset.
- No Hardcore technical knowledge required to pursue this course.

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

1. Understand the fundamental concepts and principles of digital marketing.
2. Develop practical skills to implement various digital marketing strategies and techniques.
3. Analyze and evaluate the effectiveness of digital marketing campaigns.
4. Apply critical thinking and problem-solving skills to real-world digital marketing scenarios.
5. Create comprehensive digital marketing plans and strategies.

Note: Blooms Level(BL): L1=Remember, L2=Understand, L3=Apply, L4=Analyse, L5=Evaluate, L6= Create

Contents	42 Hrs
UNIT-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
UNIT-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
UNIT-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
UNIT-4:Content creation and distribution, Content promotion and amplification, Contentmarketing metrics and analytics. Mobile Marketing: Mobile marketing overview, Mobile advertising strategies, Mobile app marketing, Location-based marketing, Mobile marketing analytics	8
UNIT-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

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

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

Program Name	B.C.A	Semester	V
Course Title	Cyber Security(Theory)/ Employability Skills		
Course Code:	SEC-4	No. of Credits	03
Contact hours	30Hrs (2+0+2 hrs/week)	Duration of SEA/Exam	01hrs
Formative Assessment Marks	20	Summative Assessment Marks	30

Course Outcomes(COs): After the successful completion of the course, the student will be able to:

CO1	After completion of this course, students would be able to understand the concept of Cyber security and issues and challenges associated with it.
CO2	Students, at the end of this course, should be able to understand the cybercrimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.
CO3	On completion of this course, students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.

Contents	30Hrs
UNIT-I. Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	10
UNIT-II . Cyber crime and Cyber law: Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies.	10
UNIT-III. Social Media Overview and Security: Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.	10

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes

Course Out comes(COs) /Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Quickly understand the given problem and come up with the correct answer															
Identify, construct and compute numerical situations by work with numbers															
Conceive and develop a methodology for analyzing data and solving a problem.															
Define, modify and apply critical thinking to real time situations.															

Pedagogy: Problem Solving

Formative Assessment for Theory	
Assessment Occasion/type	Marks
Internal Test1	10
Assignment/Surprise Test	10
Total	20Marks
<i>Formative Assessment as per guidelines.</i>	

Text/References	
1	Cyber Crime Impact in the New Millennium, by R. C Mishra , Author Press. Edition 2010
2	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3	Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13 th November, 2001)
4	Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
5	Fundamentals of Network Security by E. Maiwald, McGraw Hill.
6	Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.

Note: The classes of Cyber Security (SEC-4) will be conducted by the faculties of Computer Science.

Program Name	BCA	Semester	VI
Course Title	Artificial Intelligence and Applications (Theory)		
Course Code:	DSC16	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1	Gain a historical perspective of AI and its foundations.
CO2	Become familiar with basic principles and strategies of AI towards problem solving
CO3	Understand and apply approaches of inference, perception, knowledge representation, and learning.
CO4	Understand the various applications of AI

Contents	52 Hrs
UNIT-1: Introduction- What is Artificial Intelligence, Foundations of AI, History, AI - Past, Present and Future. Intelligent Agents- Environments- Specifying the task environment, Properties of task environments, Agent based programs-Structure of Agents , Types of agents- Simple reflex agents, Model-based reflex agents, Goal-based agents; and Utility-based agents.	10
UNIT-2: Problem Solving by Searching-Problem-Solving Agents, Well-defined problems and solutions, examples Problems, Searching for Solutions, Uninformed Search Strategies -Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, Greedy best-first search, A* Search, AO* search Informed (Heuristic) Search Strategies, Heuristic Functions	10
UNIT-3: Knowledge Representation - Knowledge-Based Agents, The Wumpus World , Logic, Propositional Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic, First-Order Logic-Syntax and Semantics of First-Order Logic, Using First-Order Logic, Unification and Lifting Forward Chaining, Backward Chaining	12
UNIT-4: Learning- Forms of Learning, Supervised Learning, Machine Learning - Decision Trees, Regression and Classification with Linear Models, Artificial Neural Networks, Support Vector Machines	10
UNIT-5: Applications of AI - Natural Language Processing, Text Classification and Information Retrieval, Speech Recognition , Image processing and computer vision, Robotics	10

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

References	
1	Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003
2	Tom Mitchell, "Machine Learning", 1 st Edition, McGraw-Hill, 2017
3	Elaine Rich, Kevin Knight, Shivashankar B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition,

Program Name	BCA	Semester	VI
Course Title	Artificial Intelligence and Applications Lab		
Course Code:	DSC16-Lab	No. of Credits	02
Contact hours	04 Hours per week	Duration of SEA/Exam	2 hours
Formative Assessment Marks	20	Summative Assessment Marks	30

Part A (Programs can be executed using Python language)

1. Write a Program to Implement Breadth First Search using Python.
2. Write a Program to Implement Depth First Search using Python.
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to Implement 8-Puzzle problem using Python.
5. Write a Program to Implement Water-Jug problem using Python.
6. Write a Program to Implement Travelling Salesman Problem using Python.
7. Write a Program to Implement Tower of Hanoi using Python.
8. Write a Program to Implement Monkey Banana Problem using Python.
9. Write a Program to Implement Alpha-Beta Pruning using Python.
10. Write a Program to Implement 8-Queens Problem using Python.

Part B

1. Write a program to implement Hill Climbing Algorithm
2. Write a program to implement A* Algorithm
3. Implementation of Python basic Libraries such as Math, Numpy and Scipy
4. Implementation of Python Libraries for ML application such as Pandas and Matplotlib
5. Creation AND Loading different datasets in Python.
6. Write a python program to compute Mean, Median, Mode, Variance and Standard Deviation using Datasets
7. Implementation of Find S Algorithm
8. Implementation of Candidate elimination Algorithm
9. Write a program to implement simple Linear Regression and Plot the graph
10. Write a Python program to implement stemming for a given sentence using NLTK.

Note: A minimum of 08 Programs should be done in each Part

Formative Assessment for Practical	
Assessment Occasion/ type	Marks
Lab Records	5
Attendance	5
Internal Assessment Test	10
Total	20 Marks
<i>Formative Assessment as per guidelines.</i>	

Program Name	BCA	Semester	VI
Course Title	PHP and MySQL (Theory)		
Course Code:	DSC17	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1	Design dynamic and interactive web pages and websites.
CO2	Run PHP scripts on the server and retrieve results.
CO3	Handle databases like MySQL using PHP in websites.

Note: Blooms Level(BL): L1=Remember, L2=Understand, L3=Apply, L4=Analyse, L5=Evaluate, L6= Create

Contents	52 Hr s
UNIT-1: Introduction to PHP: Introduction to PHP, History and Features of PHP, Installation & Configuration of PHP, Embedding PHP code in Your Web Pages, Understanding PHP, HTML and White Space, Writing Comments in PHP, Sending Data to the Web Browser, Data types in PHP, Keywords in PHP, Using Variables, Constants in PHP, Expressions in PHP, Operators in PHP.	10
UNIT-2: Programming with PHP: Conditional statements: if, if-else, switch, The ? Operator, Looping statements: while Loop, do-while Loop, for Loop Arrays in PHP: Introduction- What is Array?, Creating Arrays, Accessing Array elements, Types of Arrays: Indexed v/s Associative arrays, Multidimensional arrays, Creating Array, Accessing Array, Manipulating Arrays, Displaying array, Using Array Functions, Including and Requiring Files- use of Include() and Require(), Implicit and Explicit Casting in PHP.	12
UNIT-3: Using Functions , Class- Objects, Forms in PHP: Functions in PHP, Function definition, Creating and invoking user-defined functions, Formal parameters versus actual parameters, Function and variable scope, Recursion, Library functions, Date and Time Functions Strings in PHP: What is String?, Creating and Declaring String, String Functions	10
UNIT-4: Class & Objects in PHP: What is Class & Object, Creating and accessing a Class & Object, Object properties, object methods, Overloading, inheritance, Constructor and Destructor Form Handling: Creating HTML Form, Handling HTML Form data in PHP.	10
UNIT-5: Database Handling Using PHP with MySQL: Introduction to MySQL: Database terms, Data Types. Accessing MySQL –Using MySQL Client and Using php MyAdmin, MySQL Commands, Using PHP with MySQL: PHP MySQL Functions, Connecting to MySQL and Selecting the Database, Executing Simple Queries, Retrieving Query Results, Counting Returned Records, Updating Records with PHP.	10

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

References	
1	PHP & MySQL for Dynamic Web Sites- Fourth Edition By Larry Ullman.
2	Learning PHP, MySQL and JavaScript By Robin Nixon –O'REILLY Publications
3	Programming PHP By Rasmus Lerdorf, Kevin Tatroe, Peter MacIntyre
4	SAMS Teach Yourself PHP in 24 hours, Author: Matt Zandstra, Sams Publishing

Program Name	BCA	Semester	VI
Course Title	PHP and MySQL Lab		
Course Code:	DSC17-Lab	No. of Credits	02
Contact hours	04 Hours per week	Duration of SEA/Exam	2 hours
Formative Assessment Marks	20	Summative Assessment Marks	30

Part A

1. Write a PHPscript to find odd or even number from given number.
2. Write a PHPscript to find maximum of three numbers.
3. Write a PHPscript to swap two numbers.
4. Write a PHPscript to find the factorial of a number.
5. Write a PHPscript to check whether given number is palindrome or not.
6. Write a PHP script to reverse a given number and calculate its sum
7. Write a PHP script to generate a Fibonacci series using Recursive function
8. Write a PHP script to implement atleast seven string functions.
9. Write a PHP program to insert new item in array on any position in PHP.
10. Write a PHP script to implement constructor and destructor

Part B

1. Write a PHP script to implement form handling using get method
2. Write a PHP script to implement form handling using post method.
3. Write a PHP script that receive form input by the method post to check the number is prime or not
4. Write a PHP script that receive string as a form input
5. Write a PHP script to compute addition of two matrices as a form input.
6. Write a PHP script to show the functionality of date and time function.
7. Write a PHP program to upload a file
8. Write a PHP script to implement database creation
9. Write a PHP script to create table
10. Develop a PHP program to design a college admission form using MYSQL database.

Note: A minimum of 08 Programs should be done in each Part

Formative Assessment for Practical	
Assessment Occasion/ type	Marks
Lab Records	5
Attendance	5
Internal Assessment Test	10
Total	20 Marks
<i>Formative Assessment as per guidelines.</i>	

Program Name	BCA	Semester	VI
Course Title	DATA WAREHOUSE AND DATA MINING(Theory)		
Course Code:	DSC18	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1	To understand the principles of Data warehouses and Data Mining.
CO2	To be familiar with the Data warehouse architecture and its Implementation.
CO3	To know the Architecture of a Data Mining system.
CO4	To understand the various Data preprocessing Methods.

Contents	52 Hr s
UNIT-1: Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.	10
UNIT-2: Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture Of A Typical Data Mining Systems- Classification Of Data Mining Systems. Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.	12
UNIT-3: Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – 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 Predictor – Ensemble Methods – Model Section.	10
UNIT-4: Cluster Analysis: - 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.	10
UNIT-5: 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	10

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Program Name	B.C.A	Semester	VI
Course Title	Fundamentals of Data Science (Theory)		
Course Code:	DSE-E2	No. of Credits	03
Contact hours	42 Hours	Duration of SEA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1	Understand the concepts of data and pre-processing of data.
CO2	Know simple pattern recognition methods
CO3	Understand the basic concepts of Clustering and Classification
CO4	Know the recent trends in Data Science

Contents	42 Hrs
UNIT-1:Data Mining: Introduction, Data Mining Definitions, Knowledge Discovery in Databases (KDD) Vs Data Mining, DBMS Vs Data Mining, DM techniques, Problems, Issues and Challenges in DM, DM applications.	8
UNIT-2:Data Warehouse: Introduction, Definition, Multidimensional Data Model, Data Cleaning, Data Integration and transformation, Data reduction, Discretization	8
UNIT-3:Mining Frequent Patterns: Basic Concept – Frequent Item Set Mining Methods - Apriori and Frequent Pattern Growth (FP Growth) algorithms - Mining Association Rules	8
UNIT-4:Classification: Basic Concepts, Issues, Algorithms: Decision Tree Induction. Bayes Classification Methods, Rule-Based Classification, Lazy Learners (or Learning from your Neighbours), k Nearest Neighbour. Prediction - Accuracy- Precision and Recall	10
UNIT-5:Clustering: Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering	8

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Understand the concepts of data and pre-processing of data															
Know simple pattern recognition methods															
Understand the basic concepts of Clustering and Classification															
Know the recent trends in Data Science															

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory

Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

Text Books:

1	Jiawei Han and Micheline Kambar – —Data Mining Concepts and Techniques Second Edition Elsevier Publications
2	Arun K Pujari – —Data Mining Techniques 4th Edition, Universities Press
3	Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2012.
4	K.P.Soman, ShyamDiwakar, V.Ajay: Insight into Data Mining – Theory and Practice, PHI
5	Pang-Ning Tan, Michael Steinbach, Vipin Kumar - —Introduction to Data Mining Pearson Education

Program Name	B.C.A	Semester	VI
Course Title	Mobile Application Development (Theory)		
Course Code:	DSE-E2	No. of Credits	03
Contact hours	42 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1	Create Servlets for server side programming Create, test and debug Android application by setting up Android development environment
CO2	Critique mobile applications on their design pros and cons,
CO3	Program mobile applications for the Android operating system and understand techniques for designing and developing sophisticated mobile interfaces
CO4	Deploy applications to the Android marketplace for distribution.

Contents	42 Hrs
UNIT-1:Android OS design and Features: Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools, Building your First Android application.	8
UNIT-2:Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.	8
UNIT-3:Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.	8
UNIT-4: Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.	8
UNIT-5:Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using AndroidNetworking APIs, Using Android Web APIs, Deploying Android Application to the World.	10

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

Text Books:

1	Lauren Darcey and Shane Conder, —Android Wireless Application Development I, Pearson Education, 2nd ed. (2011)
2	Reto Meier, —Professional Android 2 Application Development I, Wiley India Pvt Ltd
3	Mark L Murphy, —Beginning Android I, Wiley India Pvt Ltd
4	Android Application Development All in one for Dummies by Barry Burd, Edition: I
5	Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013
6	Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012

Program Name	B.C.A	Semester	VI
Course Title	Web Content Management System (Theory)		
Course Code:	Voc-2	No. of Credits	03
Contact hours	42 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1	Understand content development basics;
CO2	Gain Knowledge of tools for multimedia content development for audio/ video, graphics, animations, presentations, screen casting
CO3	Host websites and develop content for social media platforms such as wiki and blog
CO4	Understand e-publications and virtual reality
CO5	Use of e-learning platform Moodle and CMS applications Drupal and Joomla

Contents	42 Hrs
UNIT-1: Web Content Development and Management, Content Types and Formats, Norms and Guidelines of Content Development, Creating Digital Graphics, Audio Production and Editing,	8
UNIT-2: Web Hosting and Managing Multimedia Content, Creating and Maintaining a Wiki Site. Presentation Software Part I, Presentation Software Part II, Screen casting Tools and Techniques, Multilingual Content Development.	8
UNIT-3: Planning and Developing Dynamic Web Content Sites, Website Design Using CSS Creating and Maintaining a WIKI Site, Creating and Managing a Blog Site,	8
UNIT-4: E-Publication Concept, E- Pub Tools, Simulation and Virtual Reality Applications, Creating 2D and 3 D Animations. Introduction to Moodle, Creating a New Course and Uploading,	10
UNIT-6: Create and Add Assessment, Add and Enroll User and Discussion Forum, Content Management System: Joomla, Content Management System: Drupal	8

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	40 Marks
<i>Formative Assessment as per guidelines.</i>	

Text Books:

1	Web Content Management: Systems, Features, and Best Practices 1st Edition by Deane Barker.
2	Content Management Bible (2nd Edition) 2nd Edition by Bob Boiko.
3	Moodle for Learning Management System (LMS): A Practical and Visual Guidebook of Administrator and Instructor for Distance Education Paperback – October 12, 2020 by James Koo
4	Using Joomla!: Efficiently Build and Manage Custom Websites 2nd Edition by Ron Severdia
Additional Reading:	
https://onlinecourses.swayam2.ac.in/cec20_lb09/preview	

Program Name	B.C.A	Semester	VI
Course Title	Internship		
Course Code:		No. of Credits	02
Contact hours	90 Hrs	Duration of SEA/Exam	01 hrs
Formative Assessment Marks	20	Summative Assessment Marks	30

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1	Internship/Project Skills
CO2	Learn Industry Standards
CO3	Adaptive Programming Skills

Contents

Internship for graduate Programme (As Per UGC & AICTE)
Methods of Evaluation: Presentations/Report submission/Activity etc.

- ❖ Internship shall be Discipline Specific of 90 hours (2 credits) with a duration 4-6 weeks.
- ❖ Internship may be full-time/part-time (full-time during semester holidays and part-time in the academic session)
- ❖ Internship mentor/supervisor shall avail work allotment during 6 th semester for a maximum of 20 hours.
- ❖ The student should submit the final internship report (90 hours of Internship) to the mentor for completion of the internship.
- ❖ The detailed guidelines and formats shall be formulated by the universities separately as prescribed in accordance to UGC and AICTE guideline

IA Theory(FORMATIVE) TEST MODEL QUESTION PAPER-1

Fifth/Six Semester BCA Degree Examination July/Aug 2023
(NEP –Syllabus-Semester Scheme)
COMPUTER SCIENCE

SUBJECT: <Name of the Subject>

Time: 2hrs

Max.Marks: 40

I. Answer any Five of the Following

5*2=10 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any Two of the Following

2*5=10 Marks

- 1.
- 2.
- 3.

III. Answer any Two of the Following

2*10=20 Marks

- 1.
- 2.
- 3.

IA Theory(FORMATIVE) TEST MODEL QUESTION PAPER-2

Fifth/Six Semester BCA Degree Examination July/Aug 2023
(NEP –Syllabus-Semester Scheme)
COMPUTER SCIENCE

SUBJECT: Cyber Security/ Logical Reasoning

Time: 1hrs

Max.Marks: 20

I. Answer any Five of the Following

5*2= 10 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any Two of the Following

2*5=10 Marks

- 1.
- 2.
- 3.
- 4.

QP Code:

Theory(Summative) EXAM MODEL QUESTION PAPER-1

Fifth/Six Semester BCA Degree Examination July/Aug 2023
(NEP –Syllabus-Semester Scheme)
COMPUTER SCIENCE

SUBJECT: <Name of the Subject>

Time: 2hrs

Max. Marks: 60

I. Answer any FIVE of the Following

5*2=10 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

II. Answer any FIVE of the Following

5*4=20 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

III. Answer any THREE of the Following

3*10=30 Marks

- 1.
- 2.
- 3.
- 4.
- 5.

QP Code:

Theory(Summative) EXAM MODEL QUESTION PAPER-2

Fifth/Six Semester BCA Degree Examination July/Aug 2023
(NEP –Syllabus-Semester Scheme)
COMPUTER SCIENCE

SUBJECT: Cyber Security / Logical Reasoning

Time: 1hrs

Max. Marks: 30

PART-A:

1. Answer all three of the following questions 3*5=15
a.
b.
c.

OR

2. Answer all three of the following questions 3*5=15
a.
b.
c.

PART-B:

3. Answer all three of the following questions 3*5=15
a.
b.
c.

OR


4. Answer all three of the following questions 3*5=15
a.
b.
c.


Registrar

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