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ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

DAVANGERE UNIVERSITY

nirf

ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾಲಯವು ಇಂಡಿಯನ್ ಸಾಲಿನಲ್ಲಿ 'ರಾಜ್ಯ ಸಾರ್ವಜನಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ' ವಿಭಾಗದಲ್ಲಿ NIRF ಶ್ರೇಯಾಂಕ 51 ರಿಂದ 100 ನೇ ಸ್ಥಾನದಲ್ಲಿದೆ

Ranked at #51-100 in the 'State Public University' Category by the NIRF Ranking 2024

NAAC ನಿಂದ "B+" ಗ್ರೇಡ್ನೊಂದಿಗೆ ಮಾನ್ಯತೆ ಪಡೆದಿದೆ

Accredited by NAAC with "B+" Grade

Syllabus for **Bachelor of Computer Applications(BCA)**

5th and 6th Semester

[As per SEP (State Education Policy): 2024-25]

WEF: 2026-27 & onwards

DEPARTMENT OF STUDIES IN COMPUTER SCIENCE, DAVANAGERE UNIVERSITY, DAVANAGERE – 577007

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Bachelor of Computer Application (BCA Semester Scheme of SEP)
Curriculum Structure for Undergraduate Programme for 2024-25 batches onwards

SEM	Title of the Paper	Teaching Hours/ week	Semester End Exam	Internal Assessment	Total Marks	Credits	Duration of the Exam
V	Analysis and Design of Algorithm	4	80	20	100	4	3
	Android programming	4	80	20	100	4	3
	Computer Networks and Data Communications	4	80	20	100	4	3
	Analysis and Design of Algorithm using Python Lab	3x2=6 (6 Hrs per week)	80	20	100	3	3
	Android programming Lab	3x2=6 (6 Hrs per week)	80	20	100	3	3
	Elementary Research Methodology	2	40	10	50	2	2
	Internal Electives (choose any one)						
	Software Engineering	4	80	20	100	3	3
	Bioinformatics	4	80	20	100	3	3
	Natural Language Processing	4	80	20	100	3	3
Total		**30**	**520**	**130**	**650**	**23**	
VI	Big Data analytics	4	80	20	100	4	3
	R Programming	4	80	20	100	4	3
	Internet Of Things	4	80	20	100	4	3
	Big Data analytics Lab	3x2=6 (6 Hrs per week)	80	20	100	3	3
	R Programming Lab	3x2=6 (6 Hrs per week)	80	20	100	3	3
	Major Project	4x2=8 (6 Hrs per week)	80	20	100	4	3
	Internal Electives (choose any one)						
	Blockchain Technologies	4	80	20	100	3	3
	Cloud Computing	4	80	20	100	3	3
	Mobile Computing	4	80	20	100	3	3
Total		**36**	**560**	**140**	**700**	**25**	

NOTE: Question paper pattern and scheme of valuation of practical and theory examination is same as that of previous year (I-VI Semester).

S. No	Semester	Total Marks	Credits
1	I	800	26
2	II	800	26
3	III	750	25
4	IV	750	25
5	V	650	23
6	VI	700	25
	Grand Total	4450	150

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BCA V Semester

Course Title: Design and Analysis of Algorithm using Python	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks: 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 04	

Course Objectives:

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations.

Course Outcomes:

1. Argue the correctness of algorithms using inductive proofs and invariants.
2. Analyze worst-case running times of algorithms using asymptotic analysis.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.

UNIT I	14 Hrs
Introduction: - What is an algorithm? Fundamentals of algorithmic problem solving, Important, problem Types, Fundamental Data Structures. Fundamentals of the Analysis of Algorithm Efficiency: - Analysis Framework(Measuring the input size, Units of measuring Running Time, Order of Growth, Worst case, best case and Average case efficiencies), Asymptotic Notation(Informal Introduction, O – notation, Ω – notation, ɵ - notation),Basic efficiency class, Mathematical analysis of non-recursive algorithms(Eg :- Largest element in a list, Element uniqueness problem), Mathematical analysis of recursive algorithms(Eg:- Factorial, Tower of Hanoi)	
UNIT II	**14 Hrs**
Brute force: - Introduction to Brute Force approach, Selection Sort, Bubble Sort, Sequential Search, Brute-Force String Matching. Exhaustive Search: - Travelling Salesman Problem, Knapsack Problem (0/1), Assignment Problem, Depth First Search, Breadth First Search	
UNIT III	**14 Hrs**
Decrease and Conquer: - Introduction and Type, Insertion Sort, Topological Sorting (Using DFS traversal & Decrease by one & conquer), Binary Search Divide-and- Conquer: - Introduction, Merge Sort, Quick Sort, Binary Tree Traversal and related properties	
UNIT IV	**14 Hrs**
Dynamic Programming: - Introduction, Coin – row problem, change making problem, Knapsack problem (0/1)Greedy Technique: - Introduction, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.	

Text Book

Introduction to Design and Analysis of Algorithms, Anany Levitin- 3rd edition, Pearson

Reference Books

1. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
3. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

BCA V Semester

Course Title: Android Programming	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks: 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 04	

Course Objectives:

1. To facilitate students to understand android SDK.
2. To help students to gain basic understanding of Android application development.
3. To understand how to work with various mobile application development frameworks.
4. To inculcate working knowledge of Android Studio development tool.

Course Outcome:

1. To identify various concepts of mobile programming that make it unique from programming for other platforms.
2. To Create, test and debug Android application by setting up Android development.
3. To Demonstrate methods in storing, sharing and retrieving data in Android applications.
4. To Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.

UNIT I	**14 Hrs**

MOBILE PLATFORM AND APPLICATIONS Mobile Device Operating Systems, Special Constraints & Requirements, Commercial Mobile Operating Systems, Software Development Kit: iOS, Android, BlackBerry, Windows Phone, MCommerce, Structure, Pros & Cons, Mobile Payment System, Security Issues. Introduction to Android: Overview, History, Features of Android, Architecture of Android, Overview of Stack, Linux Kernel, Native Libraries, Android Runtime Application Framework, Applications, SDK Overview, Platforms, Tools – (JDK, SDK, Eclipse/Android Studio, ADT, AVD, Android Emulator), Versions, Creating your first Android Application.

UNIT II	**14 Hrs**

ANDROID APPLICATION DESIGN ESSENTIALS Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

Activities, Fragments and Intents: Introduction to Activities, Activity Lifecycle, Introduction to Intents, Linking Activities using Intents. Calling built-in applications using Intents, Introduction to Fragments, Adding Fragments Dynamically, Lifecycle of Fragment, Interaction between Fragments.

UNIT III	**14 Hrs**

ANDROID USER INTERFACE DESIGN & MULTIMEDIA User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures, Using Menus with Views, Creating the helper methods, Options Menu, Context Menu.

UNIT IV	**14 Hrs**

ANDROID APIs Using Android Data and Storage APIs, managing data using SQLite: Introduction to SQLite, SQLiteOpenHelper and SQLiteDatabase, Creating, opening and closing database, working with cursors, Insert, Update, Delete, Building and executing queries, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Messaging and E-mail: SMS Messaging, Sending SMS Messages Programmatically, Getting Feedback after Sending a Message, Sending SMS Messages Using Intent, Receiving SMS Messages, Caveats and Warnings, Sending E-mail

Text Book:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

References Books:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.
2. Prasanth Kumar Pattnaik,Rajib Mall,"Fundamentals of Mobile Computing",PHI Learning Pvt.Ltd,New Delhi.

BCA V Semester

Course Title: Computer Network and Data Communications	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks: 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 04	

Learning Objectives:

1. Understand the fundamentals of data communication and computer networking
2. Explain different network models and layered architectures
3. Describe transmission media and switching techniques
4. Analyze data link, network, transport, and application layer protocols

Course Outcomes:

1. Explain basic concepts of data communication and computer networks
2. Describe network architectures and reference models
3. Analyse transmission techniques and data link layer mechanisms
4. Explain routing, transport, and application layer protocols

UNIT I	14 Hrs.

Introduction to Data Communication – Data, Information, Components of Data Communication, Data Flow. **Signals and Transmission** – Analog and Digital Signals, Signal Characteristics, Bandwidth, Throughput, Latency. **Computer Networks** – Definition, Objectives, Advantages, Applications. **Types of Networks** – LAN, MAN, WAN. **Network Topologies** – Bus, Star, Ring, Mesh, Hybrid. **Network Devices** – Hub, Switch, Bridge, Router, Repeater, Gateway, Modem

UNIT II	14 Hrs.

Layered Architecture – Need for layering, Advantages. **Network Models** – OSI Reference Model (functions of layers), TCP/IP Model. **Comparison of OSI and TCP/IP Models.**
Transmission Media – Guided Media: Twisted Pair, Coaxial Cable, Optical Fiber Unguided Media: Radio Waves, Microwaves, Infrared **Switching Techniques** – Circuit Switching, Packet Switching, Message Switching.

UNIT III	14 Hrs.

Data Link Layer – Functions and Services, Framing. **Error Detection and Correction** – Parity Check, Checksum, CRC. **Flow Control Techniques** – Stop-and-Wait Protocol, Sliding Window Protocol. **Network Addressing** – MAC Address, IP Address, Port Address. **IP Addressing** – Introduction to IPv4 and IPv6. **Routing Algorithms** – Shortest Path, Distance Vector, Link State Routing.

UNIT IV	14 Hrs.

Transport Layer – Services and Functions. **Transport Protocols** – TCP and UDP (features and comparison). **Congestion Control** – Causes and Control Techniques. **Application Layer** – DNS, HTTP, FTP, SMTP, POP, Telnet. **Introduction to Network Security** – Security Goals and Common Threats.

Text Books:

1. Andrew S. Tanenbaum – *Computer Networks*, Pearson Education.
2. Behrouz A. Forouzan – *Data Communications and Networking*, McGraw-Hill.

Reference:

1. "Data Communications and Computer Networks" — Stallings, William **(Pearson)**
2. "Computer Networking: A Top-Down Approach" — Kurose & Ross **(Addison-Wesley)**

BCA V Semester

Course Title: Analysis and Design of Algorithm using Python Lab	
Course Code: BCA	**Total Teaching Hours: 84**
IA Marks : 20	**Teaching Hours /Week: 06**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 03	

PART- A

1. Write a Python program that accepts the vertices and edges for a graph and stores it as an adjacency matrix.
2. Write a program to implement a function to print In-Degree, Out-Degree and to display that adjacency matrix.
3. Write a program to implement Tower Hanoi.
4. Write a program to sort a list of N elements using the Selection Sort Technique.
5. Write a program to sort a list of N elements using the Bubble Sort Technique.
6. Write a program to perform the Travelling Salesman Problem.
7. Write a program to implement the Exhaustive Search algorithm for the 0/1 Knapsack.
8. Write a Python program to sort a given set of n integer elements using the Merge Sort algorithm. Execute the program for different input sizes where n > 5000, measure the actual time taken to perform sorting for each input size, and record the results in a table.
9. Write a Python program to sort a given set of n integer elements using the Quick Sort algorithm. Execute the program for different input sizes where n > 5000, measure the actual time taken to perform sorting for each input size, and record the results in a table.
10. Write a program to find the minimum and maximum value in an array using divide and conquer.
11. Write a program to implement the backtracking algorithm for solving problems like N queens.
12. Write a program to implement the greedy algorithm for job sequencing with deadlines.

PART – B

1. Write a program to implement the BFS algorithm for a graph
2. Write a program to implement the DFS algorithm for a graph
3. Write a program to sort a list of N elements using the Insertion Sort Technique.
4. Write a program to search a list of N elements using Binary Search Algorithm.
5. Write a program to implement the Linear Search Algorithm.
6. Write a program to find the value of an (where a and n are integers) using both brute-force based algorithm and divide and conquer based algorithm.
7. Write a program to implement the backtracking algorithm for the sum of subsets problem
8. Write a program to implement the Dynamic Programming algorithm for the 0/1 Knapsack.
9. Write a program to implement the Dynamic Programming algorithm for the Optimal Binary Search Tree Problem.
10. Write a program that implements Prim's algorithm to generate a minimum cost spanning Tree.
11. Write a program that implements Kruskal's algorithm to generate a minimum cost spanning tree.
12. Write a program to find the shortest path to other vertices using Dijkstra's algorithm.

BCA V Semester

Course Title: Android Programming Lab	
Course Code: BCA	**Total Teaching Hours: 84**
IA Marks : 20	**Teaching Hours /Week: 06**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 03	

PART-A

1. Create an Android Application to display Davangere University as Text Message by using Button.
2. Create an Android Application to call different activities by using Implicit and Explicit Intents.
3. Create an Android Application to select item from given list by using AutoCompleteTextView (ACTV).
4. Create an Android Application to display dropdown menu items and pick one item by using Spinner Component.
5. Create an Android Application to display internal storage data using Array Adapter.
6. Create an android application to display internal storage data in vertical format by using Custom Adapter.
7. Create an Android Application to display WhatsApp videos in grid view by using Custom Adapter.
8. Create an Android Application to display webpage by using Web View Component.
9. Create an Android Application to display different webpages in fragments by using Fragments Component.
10. Create an Android Application to store the data by using Shared Preferences.
11. Create an Android Application to demonstrate concept of SQLite Database Storage method.
12. Write an android program to develop Video view application.

PART-B

1. Create an Android Application to perform different types of operations (Send SMS, making call and sending email) by using Telephony app.
2. Write an Android program to develop Media player application.
3. Create an Android application to display current location on Google maps by using Google-Maps Service.
4. Write an Android program to develop Audio Recording application.
5. Write an Android program to develop Video Recording application.
6. Write an Android program to develop Camera and Gallery application.
7. Create an Android application to get latitude and longitude value by using Location Service.
8. Create an Android application to get the Bluetooth devices and list of devices using Bluetooth and Vibrator.
9. Create an Android application to get the notifications on Notification Bar by Using Notification Service.
10. Create an Android application to display available Wi-Fi devices and Paired Wi-Fi devices by using Wi-Fi Service.
11. Create an android application to display X, Y Sensor values by using Sensor Service.
12. Create an android application to get the System Announcements by using Broadcast Receiver.

BCA V Semester

Course Title: Elementary Research Methodology	
Course Code: BCA	**Total Teaching Hours: 32**
IA Marks: 10	**Teaching Hours/Week: 02**
Exam Marks:40	**ExaminationHours:02**
Course Credits: 02	

Course Learning Objectives

1. Explain the meaning, objectives, significance, and types of research.
2. Describe the steps involved in the research process.
3. Define a research problem and justify the need for its clear formulation
4. Identify and differentiate various types of research designs
5. Explain the role of Intellectual Property Rights (IPR) in research and development.
6. Select appropriate methods for data collection based on research objectives
7. Prepare a structured research report with proper layout and format

Course Outcomes:

1. Students who complete this course will be able to understand and comprehend the basics in research methodology and apply them in research/ project work.
2. This course will help them to select an appropriate research design.
3. With the help of this course, students will be able to take up and implement a research project/ study.
4. The course will also enable them to collect the data, edit it properly and analyze it accordingly. Thus, it will facilitate students' prosperity in higher education.
5. The students will develop skills in qualitative and quantitative data analysis and presentation.
6. Students will be able to demonstrate the ability to choose methods appropriate to research objectives.

UNIT-I	08 Hrs.

Introduction-Meaning, Objectives, Types of Research, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research. **Defining the Research Problem:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.

UNIT-II	08 Hrs.

Research Design- Meaning, need for Research Design, features of a Good Design, Important Concepts relating to Research Design. Cluster Analysis: Introduction, Clustering algorithms, **Scientific Body in Research:** Ethical and scientific issues in research. A brief idea about the DST, ICMR, CSIR and UGC. Role of IPR (Intellectual Property Rights) in Research and Development.

UNIT-III	08 Hrs.

Data Collection-Introduction, Experiments and surveys, Collection of Primary and Secondary Data, selection of appropriate method for data collection. **Data Preparation**: Data Preparation process, Missing values and Outliers, types of Analysis, Statistics in research.

UNIT-IV	08 Hrs.

Testing of Hypothesis- Hypothesis, Basic Concepts Concerning Testing the Hypotheses, Test Statistic and Critical region, critical value and Decision Rule, Procedure for Hypothesis Testing. **Interpretation and Report Writing**- Meaning of Interpretation, Technique of Interpretation, Precautions in Interpretation, Significance of Report Writing, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report.

Text Books:

1. Research Methodology: A step-by-step guide for beginners, Ranjit Kumar, Sage publications.
2. Engineering Research Methodology a Practical Insight for Researchers by Dipankar Deb, RajeebDey, Valentina E. Balas.
3. Kothari C.K. (2004) 2/e, Research Methodology – Methods and Techniques (New Age International, New Delhi).
4. Montgomary, Douglas C. (2007) 5/e, Design and Analysis of Experiments (Wiley India).

Reference:

1. Montgomary, Douglas C. &Runger, George C. (2007) 3/e, Applied Statistics & probability for

Engineers (Wiley India).
2. MLA (Modern Language Association) Handbook for Writers of Research Papers, 7th edition, 2009.
3. How to Write and Publish a Scientific Paper, Cambridge University Press.
4. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.
5. Citation Analysis in Research Evaluation (Information Science and Knowledge Management) by Henk F. Moed.

BCA V Semester Elective Paper-1

Course Title: Software Engineering	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks : 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 03	

Course Learning Objectives:

1. Understand **and explain** fundamental software engineering concepts, principles, and processes.
2. Analyze **and document software requirements** using appropriate techniques.
3. Design **software systems** using structured and object-oriented design methodologies.
4. Develop **software solutions**.
5. Apply **software testing** to ensure software reliability and correctness.

Course Outcomes:

1. Explain software engineering principles, processes, and life-cycle models used in software development.
2. Analyse and document software requirements using appropriate requirement engineering techniques.
3. Design software systems using structured and object-oriented design approaches and modelling tools (e.g., UML).
4. Apply software testing, verification, and validation techniques to ensure software quality.

UNIT-I	**12 Hrs**
Introduction: Software definition, program versus software, software process, software characteristics, software applications, software myths, terminologies and role of management in Software development.	
UNIT-II	**13 Hrs.**
Software life cycle models: SDLC models: Build and fix model, The waterfall model, Increment process model, Evolutionary process models, Selection of a life cycle model.	
UNIT-III	**14 Hrs.**
Software requirements analysis and specification: Requirements engineering, Types of requirements, Feasibility study, Requirements elicitation, Requirements analysis, Requirements documentation, Requirements validation.	
UNIT-IV	**17 Hrs.**
Software Design: What is design, modularity, strategy of design, function-oriented design, IEEE recommended practice for software design descriptions, and object-oriented design. **Software Testing:** A strategic approach to software testing, some terminologies, levels of testing, and validation testing.	

Text Books:

1. Software Engineering (New Age International Publishers), "K.K. Aggarwal and Yogesh Singh". 3rd Edition. (1.2, 1.4, 1.5,1.6, 2.1 to 2.4 and 2.6, 3.1 to 3.7, 5.1 to 5.6 (Except 5.6.2 and 5.6.3), 8.5.1 to 8.5.3, 8.6.

Reference:

1. An Integrated Approach to Software Engineering, "Pankaj Jalote".
2. Software Engineering: A Practitioner's Approach, "Roger S. Pressman"

BCA V Semester Elective Paper-2

Course Title: Bioinformatics	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks : 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 03	

Course Learning Objectives

1. To use online resources, databases related to biological data.
2. To learn the underlying concepts of Bioinformatics
3. To learn the various tools in bioinformatics to manipulate and analyze biological data

Course Outcomes(COs):

1. Know the relevant online resources, databases and software tools
2. Understand the underlying concepts of Bioinformatics
3. Apply alignment and modelling tools

UNIT-I	**14 Hrs.**

Introduction to Bioinformatics: Defining the discipline, definition, paradigm shift "The IN Silico" concept, Central dogma and bioinformatics, information flow, datatypes, goal of bioinformatics, data management, algorithm development, biological interpretation, scope and applications – sequence analysis, structural bioinformatics, genome annotation, comparative genomics, drug discovery, The interdisciplinary nature.

UNIT-II	**14 Hrs.**

Biological databases: introduction to databases – concept of database, importance of databases, database management systems, classification of biological databases – primary and secondary databases, composite databases. Protein databases – sequence databases, structural databases. Specialized databases – organism specific, metabolic pathway databases, human genome specific. Data retrieval systems – Enterz (NCBI) and SRS. Data formats – FASTA format, GenBank flat file, PDB format.

UNIT-III	**14 Hrs.**

Sequence alignment: Introduction to sequence alignment – concept of homology, similarity vs identity, goal of alignment. Pairwise sequence alignment (PACA) – dot matrix method, dynamic programming. Scoring mattresses – identity scoring, substitution matrices, gap penalties. Database searching tools – BLAST (Basic Local Alignment Search Tool) and FASTA. Statistical significance – E-value and Bit score.

UNIT-IV	**14 Hrs.**

Multiple sequence alignment: Introduction to MSA – definition, biological significance. Computational challenge – complexity, dimensionality problem, NP-Completeness. Methods of multiple sequence alignment – progressive alignment, iterative alignment, block based alignment. Tools and software for MSA – ClustalW/ ClustalX, T-Coffee, MUSCLE. Visualizing and editing MSA, Applications of MSA.

Text Books:

1. Introduction to Bioinformatics: Basic Concepts and Applications by A. K. Mishra (Brillion Publishing),2020

Reference:

1. Bioinformatics: Methods And Applications Parag Rastogi and S.C. Rastogi PHI, Fourth Edition, 2004

BCA V Semester Elective Paper-3

Course Title: Natural Language Processing	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks : 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 03	

Course Learning Objectives:

By the end of this course, students will be able to:

1. Understand the significance of NLP tasks
2. Understand about syntax parsing and semantic analysis methods
3. Understand the application domains of NLP

Course Outcomes:

By the end of this course, students will be able to:

1. Demonstrate an understanding of Natural Language Processing tasks in syntax, semantics, and pragmatics.
2. Demonstrate an understanding of Morphology and Part of Speech Tagging.
3. Show how syntax parsing techniques can be used.
4. Explain the use of semantic analysis methods.

UNIT-I	14 Hrs.

Introduction: What is Natural Language Processing? Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages. **Language Modelling**: Statistical language models, including N-gram models, Grammar-based language models.

UNIT-II	13 Hrs.

Phases of NLP: Lexical and morphological analysis: tokenization, Part of speech tagging. Morphological analysis: stemming, lemmatization, understanding morphological analysis: understanding word structure, improving accuracy.

UNIT-III	13 Hrs.

Phases of NLP: Syntactic analysis (Parsing): Key components of syntactic analysis: POS tagging, ambiguity resolution. Semantic analysis: Named Entity Recognition (NER), Word sense disambiguation (WSD). Disclosure integration: Anaphora resolution, contextual references. Pragmatic analysis: Understanding intentions, Figurative meaning.

UNIT-IV	16 Hrs.

NLP TASKS: Text representation techniques and text embedding techniques. Text classification, Information extraction, Sentiment analysis, Machine translation, Text summarization, Text generation.

NLP APPLIED TO SOCIAL MEDIA AND E-COMMERCE: Applications and challenges of NLP for social media, Issues related to NLP for social media data, NLP for supporting e-commerce activities, Search in E-commerce, Building E-commerce catalog, Review analysis, recommendations for e-commerce.

Text Books:

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta and Harshit Surana, "Practical Natural Language Processing", O'Reilly Media Inc., 2021, ISBN: 978-93- 8588-918-9.
2. Multilingual Natural Language Processing Applications: From Theory to Practice Daniel M. Bikel and Imed Zitouni, Pearson Publication.

Reference:

1. Lewis Tunstall, Leandro von Werra, Thomas Wolf, "Natural Language Processing with Transformers: Building Language Applications with Hugging Face", O'Reilly Media Inc., 2022
2. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2ndEdition, Daniel Jurafsky, James H. Martin - Pearson Publication,2014.
3. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.
4. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

BCA VI Semester

Course Title: Big Data Analytics	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks : 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 04	

Course Learning Objectives

By the end of this course, students will be able to:

- To implement MapReduce programs for processing big data.
- To realize storage and processing of big data using MongoDB, Pig and Hive.
- To analyze big data using machine learning techniques.

Course Outcomes(COs):

By the end of this course, students will be able to:

- Identify and list various Big Data concepts, tools and applications.
- Develop programs using HADOOP framework.
- Use Hadoop Cluster to deploy Map Reduce jobs, PIG and HIVE programs.
- Analyze the given data set and identify deep insights from the data set.

Unit-I	**14 Hrs.**

Classification of data, Characteristics, Evolution and definition of Big data, what is Big data, Why Big data, Traditional Business Intelligence Vs Big Data, Typical data warehouse and Hadoop environment. Big Data Analytics: What is Big data Analytics, Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools, NoSQL, Hadoop.

Unit-II	**14 Hrs.**

Introduction to Hadoop: Introducing Hadoop, why Hadoop, why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System), Processing data with Hadoop, Managing resources and applications with Hadoop YARN (Yet Another Resource Negotiator). Introduction to Map Reduce Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.

Unit-III	**14 Hrs.**

Introduction to MongoDB: What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.

Unit-IV	**14 Hrs.**

Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF). Introduction to Pig: What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.

Text Books:

2. Seema Acharya and Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.

Reference:

1. Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019.

BCA VI Semester

Course Title: R Programming	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks: 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits:04	

Course Learning Objectives

1. The basics of statistical computing and data analysis
2. How to use R for analytical programming? And How to implement data structure in R?
3. R loop functions and debugging tools
4. Data visualization and Object-oriented programming concepts in R

Course Outcomes(COs):

1. To understand the fundamental syntax of R through readings, practice exercises, demonstrations, and writing R code.
2. To apply critical programming language concepts such as data types, iteration,
3. To understand control structures, functions, and Boolean operators by writing R programs and through examples
4. Describe key terminologies, concepts and techniques employed in Statistical Analysis.
5. Define Calculate, Implement Probability and Probability Distributions to solve a wide.

Unit-I	**14 Hrs.**

Introduction to R, Installation and setup, Basic syntax, comments, numeric, arithmetic, assignment, and vectors, Matrices and Arrays, Non-numeric Values, Lists and Data Frames, Special Values, Classes, and Coercion. Reading and writing files, Programming.

Unit-II	**14 Hrs.**

Functions, Calling Functions, Conditions and Loops (while, for, repeat): stand- alone statement with illustrations in exercise 10.1, stacking statements, coding loops, Writing Functions, Exceptions, Timings, and Visibility. Object-oriented programming: classes, objects, encapsulation, polymorphism, inheritance, abstraction.

Unit-III	**14 Hrs.**

Creating matrices, Matrix Operations, Applying Functions to Matrix Rows and Columns, Adding and deleting rows and columns -Vector /Matrix Distinction, Avoiding Dimension Reduction, Higher. Dimensional arrays, lists, creating lists, General list operations, accessing list components and values, applying functions to lists, recursive lists. Creating Data Frames, Matrix-like operations in frames, merging Data frames, applying functions to Data Frames, Factors and Tables, Factors and levels, Common Functions used with factors, Working with tables, other factors and table, related functions.
Data visualization: Basic plotting: Bar charts, line charts, line graphs, histograms, pie charts, scatter plots.

Unit-IV	**14 Hrs.**

Basic Statistics: Mean, median and mode, average, variance and standard deviation, probability, common probability distributions: common probability mass functions, Bernoulli, binomial, Poisson distributions, common probability density functions, uniform, normal, student's t-distribution. Simple linear regression, multiple linear regression, linear model selection and diagnostics.

Text Books:

1. Norman Matloff, —The Art of R Programming: A Tour of Statistical Software Design‖, No Starch Press, 2011.
2. Jared P. Lander, —R for Everyone: Advanced Analytics and Graphics‖, Addison-Wesley Data & Analytics Series, 2013.

Reference:

1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.
2. Michael J. Crawley, "Statistics: An Introduction using R", Second edition, Wiley,2015

BCA VI Semester

Course Title: Internet of Things	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks : 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 04	

Course Learning Objectives

1. To learn the fundamentals of the Internet of Things
2. To understand the IoT Reference Architecture
3. To learn about the basics of IoT protocols
4. Understand the role of IoT.

Course Outcomes:

1. Understand the various concepts, terminologies and architecture of IoT systems.
2. Use sensors and actuators for the design of IoT.
3. Understand and apply various protocols for the design of IoT systems
4. Understand various applications of IoT

Unit-I — **14 Hrs.**

Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, History of IoT, Various Platforms for IoT, Overview of IoT components and IoT Communication Technologies, Challenges in IoT. Communication APIs. IoT Architecture: IoT Architecture and protocols, Physical & Logical Design of IoT, Enabling Technologies in IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M, Difference between M2M and IoT.

Unit-II — **12Hrs.**

Sensors Networks: Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, Raspberry Pi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, the node, Connecting nodes, Networking Nodes, WSN and IoT.

Unit-III — **15Hrs.**

Basics of IoT Networking and communication protocols: IoT components, inter-dependencies, SoA, gateways, comparison between IoT & Web, difference protocols, complexity of networks, wireless networks, scalability, protocol classification, MQTT & SMQTT, CoAP, XMPP, AMQP. Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus.

Unit-IV — **15 Hrs.**

IP-Based Protocols for IoT: IPv6, 6LoWPAN, RPL, REST, AMQP, CoAP, MQTT. Edge connectivity and protocols. Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.

Text Books:

1. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications.

Reference:

1. 1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
2. 2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
3. https://onlinecourses.nptel.ac.in/noc17_cs22/course
4. https://nptel.ac.in/courses/106105166

BCA VI Semester

Course Title: Big Data Analytics Lab	
Course Code: BCA	**Total Teaching Hours: 84**
IA Marks: 20	**Teaching Hours /Week: 06**
Exam Marks: 80	**Examination Hours: 03**
Course Credits 03	

PART-A

1. Install Apache Hadoop
2. Visualize Data Using Basic Plotting Techniques in Python
2. Develop a MapReduce program to calculate the frequency of a given word in a given file.
3. Develop a MapReduce program to find the maximum temperature in each year.
4. Develop a MapReduce program to find the grades of students.
5. Develop a MapReduce program to implement Matrix Multiplication.
6. Develop a MapReduce to find the maximum electrical consumption in each year.
7. Develop a MapReduce to analyze weather data set and print whether the day is shinny or cool day.
8. Develop a MapReduce program to find the number of products sold in each country by considering sales data containing fields like
   - Transaction _Date
   - Product
   - Price
   - Payment _Type
   - Name
   - City
   - State
   - Country
   - Account_ Created
   - Last Login
   - Latitude
   - Longitude
9. Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.
10. XYZ.com is an online music website where users listen to various tracks. The data collected is given below. The data is coming in log files and looks as shown below.

UserId	TrackId	Shared	Radio	Skip
111115	222	0	1	0
111113	225	1	0	0
111117	223	0	1	1
111115	225	1	0	0

Write a MapReduce program to get the following:

· Number of unique listeners

· Number of times the track was shared with others

· Number of times the track was listened to on the radio

· Number of times the track was listened to in total

· Number of times the track was skipped on the radio

12. To perform data cleaning by identifying and handling missing values in a dataset using Python.

PART-B

1. To find the maximum and minimum values for each key using the MapReduce programming model.
2. Develop a MapReduce program to calculate the total population for each state from census data.
3. Develop a MapReduce program to find the maximum salary in each department of an organization.
4. Develop a MapReduce program to find the frequency of books published each year, and find in which year maximum number of books published by creating your own dataset? It must have the following columns:
   Title
   Author
   Published year
   Author country
   Language
   No of pages
5. Develop a MapReduce program to analyze Uber dataset to find the days on which each basement has more trips by creating your own dataset. The Uber dataset consists of four columns:
   dispatching_base_number
   date
   active_vehicles
   trips
6. Develop a program to calculate the maximum recorded temperature by year for the weather dataset of India
7. Write queries to sort and aggregate the data in a table using HiveQL.
8. Implement page rank algorithm using MapReduce.
9. Implement an inverted index using MapReduce.
10. Implement HDFS File Operations Using Python.
11. Develop a program to perform data cleaning by identifying and handling missing values in a dataset using Python.
12. Detect and remove duplicate records from a dataset using Python.

BCA VI Semester

Course Title: R Programming Lab	
Course Code: BCA	**Total Teaching Hours: 84**
IA Marks: 20	**Teaching Hours /Week: 06**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 03	

PART A

1. Implement different data structures in R (Vectors, Matrices, Arrays, Lists, Data Frames)
2. Write R program to find Correlation and Covariance
3. Write a program to read a xlsx, csv file and analyze the data in the file in R
4. Implement data frames in R. Write a program to join columns and rows in a data frame using c bind()and r bind() in R.
5. Implement R-Loops with different examples.
6. Design and implement an R program using R6 to demonstrate object-oriented concepts: Encapsulation, Inheritance and Polymorphism.
7. Develop a program to create two 3 × 3 matrices A and B and perform the following operations
   a) Transpose of the matrix
   b) Addition
   c) Subtraction
   d) Multiplication
8. Develop an R program to illustrate the concepts of Exceptions, Timings, and Visibility. Use tryCatch() for exception handling, system.time() to measure execution time, and demonstrate local and global variable scope in R.
9. Develop R program to create a Data Frame with following details and do the following operations.

itemCode	itemCategory	itemPrice
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

   a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
   b) Subset the Data frame and display only the items where the category is either "Office Supplies" or "Desktop Supplies".

10. Write a R program for any visual representation of an object with creating graphs using graphic functions: Plot(),Hist(),Linechart(),Pie(),Boxplot(),Scatterplots().
11. Create vectors using c(), seq(), rep(). Perform arithmetic relational and logical operations on vectors.
12. Write R programming to display Fibonacci sequence using recursion.

PART-B

1. Write a R program to create an any application of Linear Regression in multivariate context for predictive purpose.
2. Write a R program to find Mean, median, mode, variance, standard deviation.
3. Write a program to convert Decimal to Binary using recursion in R.
4. Write an R program to demonstrate Probability Mass Functions using Bernoulli, Binomial, and Poisson distributions.
5. Write an R program to generate random values from the Student's t-distribution and study its properties.
6. Write a R program to create a list containing a matrix and a list and give names to the elements in the list. Access the first and last element of the list.
7. Write a R program to create an ordered factor from data consisting of the names of months.
8. write a R program to check Armstrong number.
9. Write a R Program to Check for Leap Year using function call
10. Write a R Program to Handle missing values (NA), duplicates, and outliers.
11. Create a list containing heterogeneous data, Access, modify and append list elements.
12. Implement R script to perform various operations on vectors.

BCA VI Semester

Course Title: Major Project	
Course Code: BCA	**Total Teaching Hours:112**
IA Marks : 20	**Teaching Hours /Week: 08**
Exam Marks: 80	**Examination Hours: 03**
Course Credits: 04	

COURSE DESCRIPTION

The **Major Project** work is designed to provide students with hands-on experience in applying fundamental concepts of Computer Science and applications to solve real-world problems. This course emphasizes problem identification, basic system design, implementation, documentation, and presentation skills within a limited scope suitable for a semester-based evaluation.

COURSE OBJECTIVES

The objectives of this course are to enable students to:

- Understand and define a simple and complex computational problem
- Apply advanced programming and logical skills to develop a solution
- Design a system using standard methodologies
- Implement the solution using appropriate tools and technologies
- Document and present the project work effectively

COURSE OUTCOMES

Upon successful completion of the course, students will be able to:

CO1: Identify and formulate a problem statement relevant to Computer applications
CO2: Design a system architecture for a given problem
CO3: Implement a project using standard programming tools
CO4: Analyze and present results obtained from the project
CO5: Demonstrate communication skills during project presentation and viva voce

TEACHING AND LEARNING METHODS

- Self-learning under faculty guidance
- Practical implementation in the laboratory
- Periodic reviews and demonstrations
- Documentation and presentation practice

GENERAL PROJECT STRUCTURE

The project work report shall contain the following chapters:

1. Title Page
2. Introduction
3. Problem Statement
4. Advantages
5. Limitations
6. Applications
7. Objectives of the Project
8. Scope of the Project
9. System Requirements (Hardware and Software)
10. Methodology / Working Procedure
11. System Architecture / Block Diagram /
12. Module Description
13. Implementation Details
14. Results and Discussions.
15. Future Enhancements
16. Conclusion
17. References

VALUATION SCHEME- 80 MARKS (IA-20 + Exam-80 MARKS)

Component	Marks
Problem Statement & Objectives	10
Project Design (Methodology & Architecture)	20
Implementation / Logic	20
Output / Results	10
Documentation & Report Quality	20 (IA)
Viva Voce	20
Total	**100 Marks**

Note: Projects may be **individual or group-based** (maximum 3 students per group)

BCA VI Semester Elective Paper-1

Course Title: Block Chain Technology	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks: 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits:03	

Course Learning Objectives

By the end of this course, students will be able to:

- To Understand Blockchain terminologies with their applications. design
- To learn the working principles of Blockchain and the methodologies used in Bitcoin
- To gain knowledge on Ethereum Network, Wallets, Nodes, Smart contracts & DApps

Course Outcomes(COs):

By the end of this course, students will be able to:

- Explain the Blockchain terminologies with its applications. design
- Illustrate the working principles of Blockchain and the Smart Contract Lifecycle
- Demonstrate the principles and methodologies used in Bitcoin

Unit-I	**14 Hrs.**

Distributed systems, CAP theorem, Byzantine Generals problem, Consensus. The history of blockchain, Introduction to blockchain, Various technical definitions of blockchains, Generic elements of a blockchain, Features of a blockchain, Applications of blockchain technology, Tiers of blockchain technology, Consensus in blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Unit-II	**14 Hrs.**

Decentralization using blockchain, Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, decentralized autonomous organizations, Decentralized autonomous corporations, decentralized autonomous societies Decentralized applications, Platforms for decentralization.

Unit-III	**14 Hrs.**

Cryptographic primitives: Symmetric cryptography, Asymmetric cryptography, Public and private keys, Hash functions: Compression of arbitrary messages into fixed length digest, Easy to compute, Pre-image resistance, second pre-image resistance, Collision resistance, Message Digest (MD), Secure Hash Algorithms (SHAs), Merkle trees, Patricia trees, Distributed hash tables (DHTs), Digital signatures, Elliptic Curve Digital signature algorithm (ECDSA).

Unit-IV	**14 Hrs.**

Bitcoin, Bitcoin definition, Transactions, The transaction life cycle, The transaction structure, Types of transaction, The structure of a block, The structure of a block header, The genesis block, The bitcoin network, Wallets, Smart Contracts-History, Definition, Ricardian contracts, Smart contract templates, Oracles, Smart Oracles, Deploying smart contracts on a blockchain, The DAO.

Text Books:

1. Imran Bashir. "Mastering Blockchain", Third Edition, Packt – 2020.

Reference:

1. Andreas M., Mastering Bitcoin: Programming the Open Blockchain – O'rielly – 2017.

BCA VI Semester Elective Paper-2

Course Title: Cloud Computing	
Course Code: BCA	Total Teaching Hours: 56
IA Marks: 20	Teaching Hours/Week: 04
Exam Marks: 80	Examination Hours: 03
Course Credits: 03	

Learning Objectives:

1. Understand the fundamental concepts, architecture, and evolution of cloud computing.
2. Identify different cloud service models such as **IaaS, PaaS, and SaaS** and deployment models including **public, private, hybrid, and community clouds**.
3. Learn virtualization concepts and their role in cloud environments.

Course Outcomes:

1. Explain the concepts, characteristics, and benefits of cloud computing and distinguish between various cloud service and deployment models.
2. Describe virtualization techniques and their importance in cloud infrastructure.
3. Analyse cloud architecture and resource management strategies.

Unit-I	14 Hrs.

Introduction and principles of Parallel and Distributed Computing:
Cloud Computing at a Glance: The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead. Building Cloud Computing Environments: Application Development, Infrastructure and System Development. Elements of Parallel Computing: What is parallel Processing, Hardware Architecture for Parallel Processing, Approaches to Parallel Programming, Levels of Parallelism, Laws of Caution. Elements of Distributed Computing: Components of a Distributed System, Architectural Styles for Distributed Computing.

Unit-II	14 Hrs.

Virtualization and Cloud Computing Architecture:
Characteristics of Virtualization Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples-Xen Paravirtualization, VMware-Full Virtualization, Microsoft Hyper-V. Cloud Reference Model: Architecture, Infrastructure /Hardware as a Service, Platform as a Service, Software as a Service. Types of Clouds- Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds.

Unit-III	14 Hrs.

Aneka Cloud, Cloud Platform in Industry and Cloud Applications.
Anatomy of the Aneka Cloud Container- Platform Abstraction Layer, Fabric Services, Foundation Services, Application Services. Building Aneka Cloud- Private, Public and Hybrid Cloud Deployment Mode. Amazon Web Services- Compute Services, Storage Services, Communication Services. Microsoft Azure- Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Scientific Applications- Healthcare ECG Analysis in the Cloud, Business and Consumer Applications- CRM and ERP.

Unit-IV	14 Hrs.

Advance Topics in Cloud Computing:
Energy Efficiency in Clouds: Energy-Efficient and Green Cloud Computing Architecture. Market-Based Management of Clouds: Market-Oriented Cloud Computing, A Reference Model for MOCC, Technologies and Initiatives Supporting MOCC. Federated Clouds/Inter Cloud: Characterization and Definition, Cloud Federation Stack, Aspects of Interest, Technologies for Cloud Federations. Third Party Cloud Services: MetaCDN, SpotCloud.

Textbook:

1. Mastering Cloud Computing: Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, McGraw Hill Education (India) Private Limited.

Reference Textbooks:

1. Essentials of Cloud Computing: K Chandrasekaran, Special Indian Edition.
2. The Basics of Cloud Computing: Derrick Rountree, Ileana Castrillo.

BCA VI Semester Elective Paper-3

Course Title: Mobile Computing	
Course Code: BCA	**Total Teaching Hours: 56**
IA Marks: 20	**Teaching Hours /Week: 04**
Exam Marks: 80	**Examination Hours: 03**
Course Credits:03	

Learning Objectives:

1. Understand the fundamentals, evolution, and architecture of mobile computing systems.
2. Learn the concepts of mobile devices, mobile operating systems, and wireless communication.
3. Understand cellular networks, mobile IP, and mobility management.
4. Explore wireless technologies such as GSM, GPRS, CDMA, LTE, Wi-Fi, Bluetooth, and NFC.

Course Outcomes:

1. Explain mobile computing concepts, architecture, and components.
2. Describe mobile communication technologies and wireless network protocols.
3. Analyse mobility management techniques including handoff and roaming.
4. Understand mobile operating systems and application execution environments.

Unit-I	**14 Hrs.**

Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Emerging Technologies: Wireless broadband (WiMAX), Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6. Wireless Networks: Global Systems for Mobile Communication (GSM): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation.

Unit-II	**14 Hrs.**

Short Service Messages (SMS): Introduction to SMS, SMS Architecture, SMMT, SMMO, SMS as Information bearer, applications. GPRS and Packet Data Network: GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS. Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G.

Unit-III	**14 Hrs.**

Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux.

Unit-IV	**14 Hrs.**

Building Wireless Internet Applications: Thin client overview: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

Text Book:

1. Dr. Sunil kumar S. Manavi, Mahabaleshwar S. Kakkasageri, Wireless and Mobile Networks, concepts and protocols, Wiley, India.

Reference Book:

1. Debashis De, Mobile Cloud Computing: Architecture, Algorithm and Applications.

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