



Bengaluru North University

**National Education Policy - 2020
(NEP-2020)**

**Syllabus for Bachelor of Science (B.Sc) in Computer Science
(V & VI Semester)**

**Submitted to
Registrar
Bengaluru North University
Sri Devaraj Urs Extension
Tamaka, Kolar -563103**

Curriculum Design/Syllabus Framing Committee
Proceeding of BOS Meeting in Computer Science and BCA

The meeting of BOS in Computer Science and BCA was held at Government First Grade College, KR Puram, Bengaluru-36 On 17.08.2023 and 18.08.2023 at 11.00 am.

The chairman welcomed all the members and requested them to discuss the agenda.



Agenda :

Finalizing and approving the B.Sc Computer Science and BCA syllabus (DSC, Elective, Vocational and SEC) for V and VI semester to introduced at Undergraduate course for the academic year 2023-24.

Decision:

The BOS Members discussed in detail regarding Computer Science and BCA subject and approved the same V and VI semester syllabus for the academic year 2023-24.

The following BOS members were present

Sl. No	Name	Designation	Signature
1.	Mr. S.Manikandan Assistant Professor, Dept. of Computer Science, Government First Grade College, KR Puram, Bengaluru .	Chairperson	
2.	Dr. Murugan.K Assistant Professor, Dept. of Computer Science, Government First Grade College, KR Puram, Bengaluru .	Member	
3.	Dr. Hamela K Assistant Professor, Dept. of Computer Science, Government First Grade College , Malur.	Member	
4.	Rashmi Rao K Associate Professor, Dept. of Computer Science, Government First Grade College, Hoskote.	Member	
5.	Mr. Sankar Assistant Professor, Dept. of Computer Science, LBS Government First Grade College, RT Nagar, Bengaluru	Member	
6.	Dr. Rajendrakumar Assistant Professor, Dept. of Computer Science, Govt. College for Women, Kolar.	Member	
7.	Mrs. Lakshmi Devi M S Assistant Professor, Dept. of Computer Science, Government First Grade College, Varthur, Bengaluru.	Member	

The meeting was concluded with vote of thanks by chairman.



S.Manikandan
Chairperson
BOS-UG Computer Science & BCA(NEP)
Bengaluru North University, Kolar.

Curriculum Structure

Program: B.Sc

Subject: Computer Science

Semester	Course No.	Theory/ Practical	Credits	Paper Title	Marks	
					S.A.	I.A.
V	DSC5	Theory	4	Programming in Python	60	40
	DSC5-Lab	Practical	2	Python Programming Lab	25	25
	DSC6	Theory	4	Computer Networks	60	40
	DSC6-Lab	Practical	2	Computer Networks Lab	25	25
	DSC7	Theory	4	Software Engineering	60	40
	DSE-E1	Theory	3	A. Cloud Computing B. Business Intelligence	60	40
	Voc-1	Theory	3	Digital Marketing	60	40
	SEC-4	Theory/Practical	2	Cyber Security	30	20
VI	DSC8	Theory	4	Web Technologies	60	40
	DSC8-Lab	Practical	2	Web Technologies Lab – Java Script, HTMS, CSS Lab	25	25
	DSC9	Theory	4	Statistical Computing & R Programming	60	40
	DSC9-Lab	Practical	2	R Programming Lab	25	25
	DSC10	Theory	4	Operating System Concepts	60	40
	DSE-E2	Theory	3	A. Fundamentals of Data Science B. Mobile Application Development	60	40
	Voc-2	Theory	3	Web Content Management System	60	40
	SEC-5	Theory/Practical	2	Logical Reasoning	30	20

Program Name	B.Sc.	Semester	V
Course Title	Programming in Python (Theory)		
Course Code:	DSC5	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2:30 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	Setup python to develop simple applications
CO2	Understand the basic concepts in Python Programming
CO3	Learn how to write, debug and execute Python programs
CO4	Understand and demonstrate the use of advanced data types such as tuples, dictionaries and lists, Tuples and Sets
CO5	Design solutions for problems using object-oriented concepts in Python
CO6	Use and apply the different Python Libraries for GUI Interface, Data Analysis and Data Visualization.
CO7	Extend the knowledge of python programming to build successful career in software development.

Contents	52 Hrs
<p>Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program.</p> <p>Python Basics: Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples.</p> <p>Python Control Flow: Types of Control Flow; Control Flow Statements- if, else, elif, while loop, break, continue statements, for loop Statement; range () and exit () functions.</p>	10
<p>Exception Handling: Types of Errors; Exceptions; Exception Handling using try, except and finally.</p> <p>Python Functions: Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Recursive Functions; Scope and Lifetime of Variables in Functions.</p> <p>Strings: Creating and Storing Strings; Accessing Sting Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods.</p>	10
<p>Lists: Creating Lists; Operations on Lists; Built-in Functions on Lists; Implementation of Stacks and Queues using Lists; Nested Lists.</p> <p>Dictionaries: Creating Dictionaries; Operations on Dictionaries; Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries.</p> <p>Tuples and Sets: Creating Tuples; Operations on Tuples; Built-in Functions on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods.</p>	10
<p>File Handling: File Types; Operations on Files– Create, Open, Read, Write, Close Files; File Names and Paths; Format Operator.</p>	10

<p>Object Oriented Programming: Classes and Objects; Creating Classes and Objects; Constructor Method; Classes with Multiple Objects; Objects as Arguments; Objects as Return Values; Inheritance- Single and Multiple Inheritance, Multilevel and Multipath Inheritance; Encapsulation- Definition, Private Instance Variables; Polymorphism- Definition, Operator Overloading.</p>	
<p>GU Interface: The Tkinter Module; Window and Widgets; Layout Management- pack, grid and place. Python SQLite: The SQLite3 module; SQLite Methods- connect, cursor, execute, close; Connect to Database; Create Table; Operations on Tables- Insert, Select, Update. Delete and Drop Records. Data Analysis: NumPy- Introduction to NumPy, Array Creation using NumPy, Operations on Arrays; Pandas- Introduction to Pandas, Series and DataFrames, Creating DataFrames from Excel Sheet and .csv file, Dictionary and Tuples. Operations on DataFrames. Data Visualisation: Introduction to Data Visualisation; Matplotlib Library; Different Types of Charts using Pyplot- Line chart, Bar chart and Histogram and Pie chart.</p>	12

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	Python Programming Lab (Practical)	Practical Credits	02
Course Code	DSC5-Lab	Contact Hours	04 Hours
Formative Assessment	25 Marks	Summative Assessment	25 Marks

Practical Content

Part-A

1. Check if a number belongs to the Fibonacci Sequence
2. Solve Quadratic Equations
3. Find the sum of n natural numbers
4. Display Multiplication Tables
5. Check if a given number is a Prime Number or not
6. Implement a sequential search
7. Create a calculator program
8. Explore string functions
9. Implement Selection Sort
10. Implement Stack
11. Read and write into a file

Part-B

1. Demonstrate usage of basic regular expression
2. Demonstrate use of advanced regular expressions for data validation.
3. Demonstrate use of List
4. Demonstrate use of Dictionaries
5. Create SQLite Database and Perform Operations on Tables
6. Create a GUI using Tkinter module
7. Demonstrate Exceptions in Python
8. Drawing Line chart and Bar chart using Matplotlib
9. Drawing Histogram and Pie chart using Matplotlib
10. Create Array using NumPy and Perform Operations on Array
11. Create Data Frame from Excel sheet using Pandas and Perform Operations on DataFrames

Note: A minimum of 10 Programs should be done in each Part.

References

1	Think Python How to Think Like a Computer Scientist , Allen Downey et al., 2 nd Edition, 2015, Green Tea Press. Freely available online @ https://www.greenteapress.com/thinkpython/thinkCSpy.pdf
2	Introduction to Python Programming , Gowrishankar S et al., 2019, CRC Press
3	Python Data Analytics: Data Analysis and Science Using Pandas, matplotlib, and the Python Programming Language , Fabio Nelli, 2015, Apress®
4	Advance Core Python Programming , Meenu Kohli, 2021, BPB Publications
5	Core PYTHON Applications Programming , Wesley J. Chun, 3 rd Edition, 2012, Prentice Hall
6	Automate the Boring Stuff , Al Sweigart, 2015, No Starch Press, Inc.
7	Data Structures and Program Design Using Python , D Malhotra et al., 2021, Mercury Learning and Information LLC
8	http://www.ibiblio.org/g2swap/byteofpython/read/
9	https://docs.python.org/3/tutorial/index.html

Program Name	B.Sc.	Semester	V
Course Title	Computer Networks (Theory)		
Course Code:	DSC6	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2:30 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	Define various data communication components in networking.
CO2	Describe networking with reference to different types of models and topologies.
CO3	Understand the need for Network and various layers of OSI and TCP/IP reference model.
CO4	Explain various Data Communications media.
CO5	Describe the physical layer functions and components
CO6	Identify the different types of network topologies and Switching methods.
CO7	Describe various Data link Layer Protocols.
CO8	Identify the different types of network devices and their functions within a network.
CO9	Analyze and Interpret various Data Link Layer and Transport Layer protocols.
CO10	Explain different application layer protocols.

Contents	52 Hrs
<p>Introduction: Computer Network: Definition, Goals, Structure; Broadcast and Point-To-Point Networks; Network Topology and their various Types; Types of Network, Network software, Design issues for the layers, Connection-oriented vs. Connectionless service, Applications of Computer network, Protocols and Standards, The OSI Reference Model, The TCP/IP Protocol suite, Comparison between OSI and TCP/IP Reference model.</p>	10
<p>Physical Layer: Functions of Physical Layer, Analog signals, Digital signals, Transmission Impairment, Data Rate Limits, and Performance. Data Transmission Media: Guided Transmission Media, Magnetic Media, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Wireless Transmission, Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared Transmission, Light Transmission, Digital Modulation and Multiplexing, Public Switched Telephone Networks. Switching: Circuit switching, Message switching & Packet switching</p>	12
<p>Data Link Layer: Functions of Data Link Layer, Data Link Control: Framing, Flow and Error Control, Error Detection and Correction, High-Level Data Link Control (HDLC) & point — to — Point protocol (PPP), Channel Allocation Problem, Multiple Access: Random Access (ALOHA, CSMA, CSMA/CD, CSMA/CA), Controlled Access (Reservation, Polling, Token Passing), Channelization (FDMA, TDMA, CDMA),</p>	10
<p>Wired LAN: Ethernet Standards and FDDI, Wireless LAN: IEEE 802.11 and Bluetooth Standards.</p>	
<p>Transport Layer: Functions of Transport Layer, Elements of Transport Protocols: Addressing, Establishing and Releasing Connection, Flow Control & Buffering, Error Control, Multiplexing & De-multiplexing, Crash Recovery,</p>	10
<p>User Datagram Protocol (UDP): User Datagram, UDP Operations, Uses of UDP, RPC, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol,</p>	10

Pipelined Reliable Data Transfer Protocol, Go Back-N(GBN), Selective Repeat(SR).
Application layer : Functions of Application layer, Application Layer Protocols: DNS, DHCP, WWW, HTTP, HTTPS, TELNET, FTP, SMTP, POP, IIMAP

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	Computer Networks Laboratory (Practical)	Practical Credits	02
Course Code	DSC6 Lab	Contact Hours	04 Hours
Formative Assessment	25 Marks	Summative Assessment	25 Marks

Practical Content

Part A:

1. Prepare hardware and software specification for basic computer system and Networking.
2. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
3. Identifying the networking devices on a network.
4. Configure the IP address of the computer.
5. Create a basic network and share file and folders.
6. Study of basic network command and Network configuration commands.
7. Installation process of any open source network simulation software.

Part B:

1. Implement connecting two nodes using network simulator.
2. Implement connecting three nodes considering one node as a central node using network simulator. Implement a network to connect three nodes considering one node as a central node using network simulator
3. Implement bus topology using network simulator.
4. Implement star topology using network simulator.
5. Implement ring topology using network simulator.
6. Demonstrate the use of wireless LAN using network simulator.
7. Implement FTP using TCP bulk transfer using network simulator.
8. Implement connecting multiple routers and nodes and building a Hybrid topology network simulator.

Links for open source simulation software:

- NS3 software: <https://www.nsnam.org/releases/ns-3-30/download/>
- Packet Tracer Software: <https://www.netacad.com/courses/packet-tracer>
- GNS3 software: <https://www.gns3.com/>

Pedagogy: Demonstration, Hands on Simulation.

Formative Assessment for Practical	
Assessment Occasion/ type	Marks
Total	25 Marks
<i>Formative Assessment as per guidelines.</i>	

References

Reference Books:

1	Andrew S Tanenbaum, David. J. Wetherall, -Computer Networks, Pearson Education, 5th Edition,
2	Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, Fourth Edition
3	Kurose and Ross, Computer Networking- A Top-Down approach, Pearson, 5 th edition
4	William Stallings, Data and Computer Communications, 7th Edition,PHI.
4	http://highered.mheducation.com/sites/0072967757/index.html
7	Larry L. Peterson, Bruce S. Davie, -Computer Networks: A Systems Approach, Morgan Kaufmann Publishers, Fifth Edition, 2011.
8	Brijendrasingh, Data Communication and Computer Networks,PHI.

Program Name	B.Sc.	Semester	V
Course Title	Software Engineering (Theory)		
Course Code:	DSC7	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2:30 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
OVERVIEW: Introduction; Software engineering ethics; Software process models; Process activities; Coping with change; Agile software development: Agile methods; Plan-driven and agile development.	10
REQUIREMENTS ENGINEERING: Functional and non-functional requirements; Software requirements document; Requirement's specification; Requirements engineering processes; Requirement's elicitation and analysis; Requirement's validation; Requirements management.	10
SYSTEM MODELING: Context models; Interaction models- Use case modeling, Sequence diagrams; Structural models- Class diagrams, Generalization ,Aggregation; Behavioral models- Data-driven modeling, Event-driven modeling; Model-driven engineering.	10
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
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 Engineering| 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 Approach|,7th Edition, McGraw-Hill, 2007.

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

Program Name	B.Sc./B.C.A.	Semester	V
Course Title	Cloud Computing (Theory)		
Course Code:	DSE-E1	No. of Credits	03
Contact hours	42 Hours	Duration of SEA/Exam	2:30 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
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
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
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
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
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.	
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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	B.Sc./BCA	Semester	V
Course Title	Business Intelligence (Theory)		
Course Code:	DSE-E1	No. of Credits	03
Contact hours	42 Hours	Duration of SEA/Exam	2:30 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
Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics	8
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
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
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
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, 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.Sc./B.C.A	Semester	VI
Course Title	Digital Marketing (Theory)		
Course Code:	Voc-2	No. of Credits	03
Contact hours	42 Hours	Duration of SEA/Exam	2:30 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
Introduction to Digital Marketing: Overview of digital marketing, Evolution of digital marketing, Importance and benefits of digital marketing, Digital marketing channels and platforms	8
Digital Marketing Strategy and Planning: Developing a digital marketing strategy, Setting goals and objectives, Budgeting and resource allocation.	
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
Email Marketing: Introduction to email marketing, Building an email list, Creating effective email campaigns, Email automation and segmentation, Email marketing metrics and analytics	8
Content Marketing: Understanding content marketing, Content strategy and planning,	
Content creation and distribution, Content promotion and amplification, Content marketing metrics and analytics.	
Mobile Marketing: Mobile marketing overview, Mobile advertising strategies, Mobile app marketing, Location-based marketing, Mobile marketing analytics	8
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.Sc.	Semester	VI
Course Title	Web Technologies (Theory)		
Course Code:	DSC8	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2:30 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 basics of web technology
CO2	Recognize the different Client-side Technologies and tools like, HTML, CSS, JavaScript
CO3	Learn Java Servlets and JDBC
CO4	Web Technology for Mobiles and Understand web security

Contents	52 Hrs
Introduction and Web Design: Introduction to Internet, WWW and Web 2.0, Web browsers, Web protocols and Web servers, Web Design Principles and Web site structure, client-server technologies, Client side tools and technologies, Server side Scripting, URL, MIME, search engine, web server- Apache, IIS, proxy server, HTTP protocol. Introductions to HTML. HTML5 Basics tags, Formatting tags in HTML, HTML5 Page layout and Navigation concepts, Semantic Elements in HTML, List, type of list tags, tables and form tags in HTML, multimedia basics, images, iframe, map tag, embedding audio and video clips on webpage.	11
Introduction to XML: XML Syntax, XML Tree, Elements, Attributes, Namespace, Parser, XSLT DOM, DTD, Schema. Introduction to CSS, CSS syntax, CSS selectors, CSS Background Cursor, CSS text fonts, CSS-List Tables, CSS Box Modeling, Display Positioning, Floats, CSS Gradients, Shadows, 2D and 3 Transform, Transitions, CSS Animations.	10
Introduction to JavaScript: JavaScript Data type and Variables, JavaScript Operators, Conditional Statements, Looping Statements, JavaScript Functions, Number, Strings, Arrays, Objects in JavaScript, Window and Frame objects, Event Handling in JavaScript, Exception Handling, Form Object and DOM, JSON, Browser Object Model.	11
Introduction to Servlets: Common Gateway Interface (CGI), Lifecycle of a Servlets, deploying a Servlets, The Servlets API, Reading Servlets parameters, reading initialization parameters, Handling HTTP Request & Responses, Using Cookies and sessions, connecting to a database using JDBC.	10
Web Security: Authentication Techniques, Design Flaws in Authentication, Implementation Flaws in Authentication, Securing Authentication, Path Traversal Attacks. Injecting into Interpreted Contexts, SQL Injection, NoSQL Injection, XPath Injection, LDAP Injection, XML Injection, HTTP Injection, Mail Service Injection. Types of XSS, XSS in Real World, Finding and Exploiting XSS Vulnerabilities, Preventing XSS Attacks.	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	Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dremtech
2	Java Server Pages – Hans Bergsten, SPD O’Reilly
3	Java Script, D.Flanagan, O’Reilly, SPD
4	Beginning Web Programming-Jon Duckett WROX.
5	Web Applications : Concepts and Real World Design, Knuckles, Wiley-India
6	Internet and World Wide Web – How to program, Dietel and Nieto, Pearson.

Program Name	B.Sc.	Semester	VI
Course Title	Web Technologies Lab		
Course Code:	DSC8-Lab	No. of Credits	02
Contact hours	04 Hours per week	Duration of SEA/Exam	1:30 hours
Formative Assessment Marks	25	Summative Assessment Marks	25

Part A

1. Design web pages for your college containing college name and Logo, departments list using href, list tags.
2. Create a class timetable using table tag.
3. Write a HTML code to design Student registrations form for your college Admission
4. Design Web Pages with includes Multi-Media data (Image, Audio, Video, GIFs etc)
5. Create a web page using frame.
6. Write code in HTML to develop a webpage having two frames that divide the webpage into two equal rows and then divide the row into equal columns fill each frame with a different background color.
7. Write CSS code to Use Inline CSS to format your ID Card.
8. Using HTML, CSS create display a text called -Hello India !|| on top of an image of India-Map using an overlay.

Part B

1. Write a JavaScript Program to perform Basic Arithmetic operations
2. JavaScript Program to Check Prime Number
3. JavaScript Program to implement Javascript Object Concept
4. JavaScript Program to Create Array and inserting Data into Array
5. JavaScript Program to Validate an Email Address
6. Write a Program for printing System Date & Time using SERVLET
7. Write a server side SERVLET program for accept number from HTML file and Display.
8. Write a program to Creating the Life-Cycle Servlet Application

Program Name	B.Sc.	Semester	VI
Course Title	Statistical Computing & R Programming (Theory)		
Course Code:	DSC9	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2:30 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
Introduction of the language, numeric, arithmetic, assignment, and vectors, Matrices and Arrays, Non-numeric Values, Lists and Data Frames, Special Values, Classes, and Coercion, Basic Plotting.	10
Reading and writing files, Programming, Calling Functions, Conditions and Loops: stand-alone statement with illustrations in exercise 10.1, stacking statements, coding loops, Writing Functions, Exceptions, Timings, and Visibility.	10
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
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
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 sttisticsl, San Francisco, 2016.
2	Vishwas R. Pawgi, -Statistical computing using R softwarell, 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	B.Sc.	Semester	VI
Course Title	R Programming Lab		
Course Code:	DSC9 Lab	No. of Credits	02
Contact hours	04 Hours per week	Duration of SEA/Exam	1:30 hours
Formative Assessment Marks	25	Summative Assessment Marks	25

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, Analyse, and Interpret Correlation Probability and Regression to analyse the underlying relationships between different variables.
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 dataframe objects, indexing and subsetting data frames, and employ manipulating and analyzing data.
 10. Write a program to create an any application of Linear Regression in multivariate context for predictive purpose.

Program Name	B.Sc.	Semester	VI
Course Title	Operating System (Theory)		
Course Code:	DSC10	No. of Credits	04
Contact hours	52 Hours	Duration of SEA/Exam	2:30 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 fundamentals of the operating system.
CO2	Comprehend multithreaded programming process management, process synchronization, memory management and storage management.
CO3	Compare the performance of Scheduling Algorithms
CO4	Identify the features of I/O and File handling methods.

Contents	52 Hrs
INTRODUCTION TO OPERATING SYSTEM: What Operating Systems Do? Computer -System organization; Computer-System Architecture; Operating-System Operations; Operating-System Services; User and Operating-System Interface; System Calls; System Services.	10
PROCESS MANAGEMENT: Process Concept; Process scheduling; Operations on Processes; Inter process communication; IPC in Shared- Memory Systems; IPC in Message-Passing Systems.	10
CPU SCHEDULING: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Real-Time CPU Scheduling. PROCESS SYNCHRONIZATION: Critical Section Problem and Peterson's Solution; Semaphores; Monitors; Classic Problems of Synchronization; Synchronization within the Kernel.	12
DEADLOCKS: System Model; Deadlocks Characterization; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection.	10
MEMORY MANAGEMENT: Contiguous Memory Allocation; Paging; Structure of the Page Table; Swapping.	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.	Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne ^{8th} Edition, Wiley, 2009.
References Books:	
1	Understanding Operating Systems, McHoes A et al., 7 th Edition, CengageLearning, 2014.
2	Operating Systems - Internals and Design Principles, William Stallings, 9th Edition, Pearson.
3	Operating Systems – A Concept Based Approach, Dhamdhare, 3rd Edition, McGrawHill Education India.
4	Modern Operating Systems, Andrew S Tanenbaum, 4th Edition, Pearson.
5	Operating System Concepts - Engineering Handbook, Ghosh PK, 2019.

Program Name	B.Sc./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	2:30 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 I: 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
Data Warehouse: Introduction, Definition, Multidimensional Data Model, Data Cleaning, Data Integration and transformation, Data reduction, Discretization	8
Mining Frequent Patterns: Basic Concept – Frequent Item Set Mining Methods -Apriori and Frequent Pattern Growth (FPGrowth) algorithms -Mining Association Rules	8
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
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 4 th 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.Sc./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	2:30 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
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
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
Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.	8
Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.	8
Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking 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, Pearson Education, 2nd ed. (2011)
2	Reto Meier, —Professional Android 2 Application Development, Wiley India Pvt Ltd
3	Mark L Murphy, —Beginning Android, 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.Sc./B.C.A	Semester	V
Course Title	Web Content Management System (Theory)		
Course Code:	Voc-1	No. of Credits	03
Contact hours	42 Hours	Duration of SEA/Exam	2:30 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
Web Content Development and Management, Content Types and Formats, Norms and Guidelines of Content Development, Creating Digital Graphics, Audio Production and Editing,	8
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
Planning and Developing Dynamic Web Content Sites, Website Design Using CSS Creating and Maintaining a WIKI Site, Creating and Managing a Blog Site,	8
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
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.Sc./B.C.A	Semester	VI
Course Title	Logical Reasoning (Theory)		
Course Code:	SEC-5	No. of Credits	02
Contact hours	30 Hrs	Duration of SEA/Exam	01 hrs
Formative Assessment Marks	30	Summative Assessment Marks	20

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

CO1	Quickly understand the given problem and come up with the correct answer
CO2	Identify, construct and compute numerical situations by work with numbers
CO3	Conceive and develop a methodology for analyzing data and solving a problem
CO4	Define, modify and apply critical thinking to real time situations

Contents	30 Hrs
Arithmetic Reasoning: Analytical Thinking, Syllogistic Logic, Problem solving; Number System; LCM & HCF; Divisibility Test; Surds and Indices; Logarithms; Ratio, Proportions and Variations; Partnership; Time speed and distance; work time problems;	10
Data Interpretation: Numerical Data Tables; Line Graphs; Bar Charts and Pie charts; Mix Diagrams; Geometrical Diagrams, and other forms of Data Representation	10
Lateral Thinking, Reasoning & Logic: Verbal and Non-verbal Logic, Family Tree; Linear Arrangements; Circular and Complex Arrangement; Conditionality and Grouping; Sequencing and Scheduling; Selections; Networks; Venn Diagram in Logical Reasoning.	10

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

Course Outcomes (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 Test 1	30%
Assignment / Surprise Test/	20%
Total	25 Marks
<i>Formative Assessment as per guidelines.</i>	

References

1	R.S. Aggarwal - A Modern Approach to Verbal and Non-Verbal Reasoning Sultan Chand and Sons, New Delhi
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References

2	R.S.Aggarwal--Quantitative Aptitudell, Sultan Chand and Sons, New Delhi
3	Dr.Ravi Chopra --Verbal and Non-Verbal Reasoningll, MacMillan India
4	Dr.Edward DeBono --Lateral Thinkingll, Penguin Books, New Delhi