# Department of Information Technology

## Syllabus of B.Sc. in Information Technology (Big Data Analytics)

## (Effective from academic session 2019-20)

### Semester-IV

| | |
|---|---|
| **Name of the Course: B.Sc. in Information Technology (Big Data Analytics)**<br>**Subject:** Computer Networks & Computer Networks Lab | |
| **Course Code:** BITBDA401 & BITBDA491 | **Semester: IV** |
| **Duration:** 36 Hrs. | **Maximum Marks: 100 + 100** |
| **Teaching Scheme** | **Examination Scheme** |
| **Theory: 3 Hrs./week** | **End Semester Exam: 70** |
| **Tutorial: 0** | **Attendance : 5** |
| **Practical: 4 Hrs./week** | **Continuous Assessment: 25** |
| **Credit: 3 + 2** | **Practical Sessional internal continuous evaluation: 40** |
| | **Practical Sessional external examination: 60** |

| **Aim:** | |
|---|---|
| **Sl. No.** | |
| 1. | To gain knowledge of computer networks. |
| 2. | To gain knowledge of several layers and network architectures |
| 3. | To gain knowledge of communication through networks, protocols and algorithms. |
| **Objective:** | |
| **Sl. No.** | |
| 1. | Understand the division of network functionalities into layers. |
| 2. | Be familiar with the components required to build different types of networks Be exposed to the required functionality at each layer |
| 3. | Learn the flow control and congestion control algorithms |
| **Pre-Requisite:** | |
| **Sl. No.** | |
| 1. | Understanding of algorithms |
| 2. | Understanding of basic computer architecture |

| **Contents** | | **3 Hrs./week** | |
|---|---|---|---|
| **Chapter** | **Name of the Topic** | **Hours** | **Marks** |
| 01 | **FUNDAMENTALS & LINK LAYER**<br>Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Performance ; Link layer Services – Framing – Error Detection – Flow control | **7** | **14** |
| 02 | **MEDIA ACCESS & INTERNETWORKING**<br>Media access control – Ethernet (802.3) – Wireless LANs – 802.11 – Bluetooth – Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP,ICMP ) | **7** | **14** |
| 03 | **ROUTING**<br>Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM) | **7** | **14** |
| 04 | **TRANSPORT LAYER**<br>Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP | **8** | **14** |

| | | | |
|---|---|---|---|
| | Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements | | |
| 05 | **APPLICATION LAYER**<br>Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP | **7** | **14** |
| | **Sub Total:** | **36** | **70** |
| | **Internal Assessment Examination & Preparation of Semester Examination** | **4** | **30** |
| | **Total:** | **40** | **100** |

**Practical:**

**Skills to be developed:**

Intellectual skills:

1. Identify the components required to build different types of networks
2. Choose the required functionality at each layer for given application
3. Identify solution for each functionality at each layer
4. Trace the flow of information from one node to another node in the network

**List of Practical:**

Haqnd on experiments based on theory lectures.

**Assignments:**

Adhered to theory curriculum as conducted by the subject teacher.

**List of Books**

**Text Books:**

| **Name of Author** | **Title of the Book** | **Edition/ISSN/ISBN** | **Name of the Publisher** |
|---|---|---|---|
| Larry L. Peterson, Bruce S. Davie | Computer Networks: A Systems Approach | Fifth | Morgan Kaufmann Publishers |
| Behrouz A. Forouzan | Data Communication and Networking | Fourth | Tata McGraw – Hill |
| James F. Kurose, Keith W. Ross | Computer Networking – A Top-Down Approach Featuring the Internet | Fifth | Pearson Education |
| **Reference Books:** | | | |
| Nader. F. Mir | Computer and Communication Networks | | Pearson Prentice Hall Publishers |
| Ying-Dar Lin, Ren-Hung Hwang, Fred Baker | Computer Networks: An Open Source Approach | | McGraw Hill Publisher |

**List of equipment/apparatus for laboratory experiments:**

| Sl. No. | |
|---|---|
| 1. | Computer with Internet Connection |

**End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.**

| Group | Unit | Objective Questions (MCQ only with the correct answer) | | Subjective Questions | | | |
|---|---|---|---|---|---|---|---|
| | | No of question to be set | Total Marks | No of question to be set | To answer | Marks per question | Total Marks |
| **A** | **1 to 5** | **10** | **10** | | | | |
| **B** | **1 to 5** | | | **5** | **3** | **5** | **60** |
| **C** | **1 to 5** | | | **5** | **3** | **15** | |

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

**Examination Scheme for end semester examination:**

| Group | Chapter | Marks of each question | Question to be set | Question to be answered |
|---|---|---|---|---|
| **A** | **All** | **1** | **10** | **10** |
| **B** | **All** | **5** | **5** | **3** |
| **C** | **All** | **15** | **5** | **3** |

**Examination Scheme for Practical Sessional examination:**

**Practical Internal Sessional Continuous Evaluation**

**Internal Examination:**

| | | | |
|---|---|---|---|
| Continuous evaluation | | | **40** |

**External Examination: Examiner-**

| | | |
|---|---|---|
| Signed Lab Assignments | **10** | |
| On Spot Experiment | **40** | |
| Viva voce | **10** | **60** |

| | | | |
|---|---|---|---|
| **Name of the Course: B.Sc. in Information Technology (Big Data Analytics)**<br>**Subject:** Advanced RDBMS & Advanced RDBMS Lab | | | |
| **Course Code:** BITBDA402 & BITBDA492 | **Semester: IV** | | |
| **Duration: 36 Hrs.** | **Maximum Marks: 100+100** | | |
| **Teaching Scheme** | **Examination Scheme** | | |
| **Theory: 3 Hrs./week** | End Semester Exam: 70 | | |
| **Tutorial: 0** | Attendance : 5 | | |
| **Practical:4 Hrs./week** | Continuous Assessment:25 | | |
| **Credit: 3+2** | Practical Sessional internal continuous evaluation:40 | | |
| | Practical Sessional external examination:60 | | |
| **Aim:** | | | |
| **Sl. No.** | | | |
| **1.** | Understand what is Distributed DBMS | | |
| **2.** | Understand various architectures of D\DBMS | | |
| **Objective:** | | | |
| **Sl. No.** | | | |
| **1.** | Apply various fragmentation techniques given a problem | | |
| **2.** | Understand and calculate the cost of enforcing semantic integrity control | | |
| **3.** | . Understand the steps of query processing | | |
| **4.** | How optimization techniques are applies to Distributed Database | | |
| **5.** | Learn and understand various Query Optimization Algorithms | | |
| **6.** | Understand Transaction Management & Compare various approaches to concurrency control in Distributed database | | |
| **7.** | Understand various algorithms and techniques for deadlock and recovery in Distributed database | | |
| **Pre-Requisite:** | | | |
| **Sl. No.** | | | |
| 1. | Knowledge in Database Management System | | |
| 2. | Basic Programming Skill | | |
| **Contents** | | **Hrs./week** | |
| **Chapter** | **Name of the Topic** | **Hours** | **Marks** |
| 01 | **Introductory concepts and design of (DDBMS)**<br><br>Data Fragmentation; Replication; and allocation techniques for DDBMS; Methods for designing and implementing DDBMS, designing a distributed relational database; Architectures for DDBMS: cluster federated, parallel databases and client server architecture. | **6** | **10** |
| 02 | **Query processing & Transaction Management**<br><br>Query processing problem; Objectives of Query Processing; Complexity of Relational Algebra operations; characterization of Query processors; Layers of Query Processing Introduction To | **8** | **20** |

| | | | |
|---|---|---|---|
| | Transaction Management: Definition of Transaction, Properties of Transaction, types of transaction ; Distributed Concurrency Control: Serializability theory; Taxonomy of concurrency control mechanisms; locking bases concurrency control algorithms. | | |
| 03 | **Distributed Object Database Management systems** Fundamental Object concepts and Object models; Object distribution design; Architectural issues; Object management; Distributed object storage; Object query processing | **8** | **15** |
| 04 | **Current trends & developments related to Distributed database applications technologies**<br><br>Distributed Object/component-based DBMS; Database Interoperability including CORBA; DCOM and Java RMI; Distributed document-based systems; XML and Workflow management. | **6** | **15** |
| 05 | **Emerging related database technologies**<br><br>Parallel Database; Mobile database; Multimedia Database; Spatial Database and Web Databases. | **8** | **10** |
| | **Sub Total:** | **36** | **70** |
| | **Internal Assessment Examination & Preparation of Semester Examination** | **4** | **30** |
| | **Total:** | **40** | **100** |

**Practical:**

**Skills to be developed:**

Intellectual skills:

student will be able to:

1. Identify the introductory distributed database concepts and its structures.
2. Describe terms related to distributed object database design and management.
3. Produce the transaction management and query processing techniques in DDBMS.
4. Relate the importance and application of emerging database technology.

**List of Practical:**

1. Write a program to execute concurrent echo client-server application using Socket Programming.
2. Write a program to execute concurrent day-time client-server application.
3. Write a program to execute following options on server socket and tests them: SO_KEEPALIVE, SO_LINGER, SO_SNDBUF, SO_RCVBUF, TCP_NODELAY
4. Write a program to execute inter-process communication using socket programming: implementing multithreaded echo server
5. Write a program to execute incrementing a counter in shared memory.
6. Write a program to execute create CORBA based server-client application.
7. Write a program to design XML Schema and XML instance document.
8 Write a program to execute WSDL based: Implement Arithmetic Service that implements add, and subtract operations / Java based: Implement Trigonometric Service that implements sin and cos operations.
9. Write a program to execute Configuring reliability and security options.

10. Monitor SOAP request and response packets. Analyze parts of it and compare them with the operations (java functions) headers.
11. Write a program to design and test BPEL module that composes Arithmetic Service and Trigonometric Service.
12. Implementing Publish/Subscribe Paradigm using Web Services, ESB and JMS.
13. Implementing Stateful grid services using Globus WS-Core-4.0.3.
14. Study of Distributed File System: NFS – CODA.
15. Study of Distributed File System: NFS – CODA.
16. Study of distributed architecture CORBA, Grid and clusters

**Assignments:**
Based on the curriculum as covered by subject teacher.

**List of Books**
**Text Books:**

| Name of Author | Title of the Book | Edition/ISSN/ISBN | Name of the Publisher |
|---|---|---|---|
| Stefano Ceri; Guiseppe Pelagatti | Distributed Databases - Principles and System | | Tata McGraw Hill |
| Fundamental of Database Systems | Elmasri & Navathe | | Pearson Education |
| M. Tamer Özsu; and Patrick Valduriez | Principles of Distributed Database Systems | | Prentice Hall |
| | | | |
| | | | |
| **Reference Books:** | | | |
| Rajiv Chopra | **Database Management Systems (DBMS)** | | |
| Silberschatz | **Database System Concepts** | | |
| Saeed K. Rahimi and Frank S. Haug | **Distributed Database Management Systems: A Practical Approach** | **2010** | |
| Himanshu Dabir (Author), Dipali Meher (Author) | **Advanced Rdbms Using Oracle** | 9350161508 | |
| | | | |
| **List of equipment/apparatus for laboratory experiments:** | | | |
| Sl. No. | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | | **Computer** | | | | | |
| 2. | | **Oracle Software** | | | | | |
| **End Semester Examination Scheme.** | | **Maximum Marks-70.** | | | | **Time allotted-3hrs.** | |
| **Group** | **Unit** | **Objective Questions** (MCQ only with the correct answer) | | **Subjective Questions** | | | |
| | | No of question to be set | Total Marks | No of question to be set | To answer | Marks per question | Total Marks |
| **A** | **1 to 7** | **10** | **10** | | | | **60** |
| **B** | **1 to 7** | | | **5** | **3** | **5** | |
| **C** | **1 to 7** | | | **5** | **3** | **15** | |

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

**Examination Scheme for end semester examination:**

| **Group** | **Chapter** | **Marks of each question** | **Question to be set** | **Question to be answered** |
|---|---|---|---|---|
| **A** | **All** | **1** | **10** | **10** |
| **B** | **All** | **5** | **5** | **3** |
| **C** | **All** | **15** | **3** | **3** |

**Examination Scheme for Practical Sessional examination:**

**Practical Internal Sessional Continuous Evaluation**

**Internal Examination:**

| | | | |
|---|---|---|---|
| Continuous evaluation | | | **40** |

**External Examination: Examiner-**

| | | |
|---|---|---|
| Signed Lab Note Book | **10** | |
| On Spot Experiment | **40** | |
| Viva voce | **10** | **60** |

| | |
|---|---|
| **Name of the Course: BSc. in Information Technology (Big Data Analytics)**<br><br>**Subject:** Design & Analysis of Algorithms & Design & Analysis of Algorithms Lab | |
| **Course Code:** BITBDA403 & BITBDA493 | **Semester: IV** |
| **Duration: 36 Hrs** | **Maximum Marks:100+100** |
| **Teaching Scheme** | **Examination Scheme** |
| **Theory: 3 Hrs./week** | End Semester Exam:70 |
| **Tutorial: 0** | Attendance: 5 |
| **Practical: 4 Hrs./week** | Continuous Assessment: 25 |
| **Credit: 3+2** | Practical Sessional internal continuous evaluation: 40 |
| | Practical Sessional external examination: 60 |

**Aim:**

| **Sl. No.** | |
|---|---|
| 1. | The point of this course is to give you a vibe for algorithms and data structures as a focal area of what it is to be a computer science student. |
| 2. | You ought to know about the way that there are regularly a few calculations for some issue, and one calculation might be superior to another, or one calculation better in certain conditions and another better in others. |
| 3. | You should have some idea of how to work out the efficiency of an algorithm. |
| 4. | You will be able to use and design linked data structures |
| **5.** | You will learn why it is good programming style to hide the details of a data structure within an abstract data type. |
| **6.** | You should have some idea of how to implement various algorithm using python programming. |

**Objective:**

| **Sl. No.** | |
|---|---|

| | |
|---|---|
| 1. | To impart the basic concepts of data structures and algorithms. |
| 2. | To understand concepts about searching and sorting techniques. |
| 3. | To understand basic concepts about stacks,queues,lists,trees and graphs. |
| 4. | To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures |

**Pre-Requisite:**

| **Sl. No.** | |
|---|---|
| 1. | **Basics of programming language.** |
| 2. | **Logic building skills.** |
| | |

| **Contents** | | **3 Hrs./week** | |
|---|---|---|---|
| **Chapter** | **Name of the Topic** | **Hours** | **Marks** |
| 01 | **Introduction to Data Structure**<br><br>Abstract Data Type. | **1** | **2** |
| 02 | **Arrays**<br><br>1D, 2D and Multi-dimensional Arrays, Sparse Matrices. Polynomial representation . | **3** | **4** |
| 03 | **Linked Lists**<br><br>Singly, Doubly and Circular Lists, Normal and Circular representation of Self Organizing Lists, Skip Lists, Polynomial representation. | **4** | **7** |
| 04 | **Stacks**<br><br>Implementing single / multiple stack/s in an Array, Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another, Applications of stack, Limitations of Array representation of stack. | **4** | **10** |

| | | | |
|---|---|---|---|
| 05 | **Queues**<br><br>Array and Linked representation of Queue, Circular Queue, De-queue, Priority Queues. | **4** | **7** |
| 06 | **Recursion**<br><br>Developing Recursive Definition of Simple Problems and their implementation, Advantages and Limitations of Recursion, Understanding what goes behind Recursion (Internal Stack Implementation) | **4** | **5** |
| 07 | **Trees**<br><br>Introduction to Tree as a data structure, Binary Trees (Insertion, Deletion, Recursive and Iterative Traversals of Binary Search Trees), Threaded Binary Trees (Insertion, Deletion, Traversals), Height-Balanced Trees (Various operations on AVL Trees). | **5** | **15** |
| 08 | **Searching and Sorting**<br><br>Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Merge Sort, Quick sort, Shell Sort, Comparison of Sorting Techniques | **6** | **15** |
| 09 | **Hashing**<br><br>Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table Reordering, Resolving collision by Open Addressing, Coalesced Hashing, Separate Chaining, Dynamic and Extendible Hashing, Choosing a Hash Function, Perfect Hashing Function. | **5** | **5** |
| | **Sub Total:** | **36** | **70** |
| | **Internal Assessment Examination & Preparation of Semester Examination** | **4** | **30** |
| | **Total:** | **40** | **100** |
| **Practical:**<br><br>**Skills to be developed:** | | | |

Intellectual skills:

1. Skill to analyze algorithms and to determine algorithm correctness and their time efficiency.
2. Knowledge of advanced abstract data type (ADT) and data structures and their implementations.
3. Ability to implement algorithms to perform various operations on data structures.

**List of Practical:**

1. Implementation of array operations.
2. Stacks and Queues: adding, deleting elements .
3. Circular Queue: Adding & deleting elements
4. Merging Problem : Evaluation of expressions operations on Multiple stacks & queues
5. Implementation of linked lists: inserting, deleting, inverting a linked list.
6. Implementation of stacks & queues using linked lists:
7. Polynomial addition, Polynomial multiplication
8. Sparse Matrices : Multiplication, addition.
9. Recursive and Non Recursive traversal of Trees Threaded binary tree traversal.AVL tree implementation Application of Trees.
10. Application of sorting and searching algorithms Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

**Assignments:**

Based on the curriculum as covered by subject teacher.

**List of Books**

**Text Books:**

| Name of Author | Title of the Book | Edition/ISSN/ISBN | Name of the Publisher |
|---|---|---|---|
| Michael H. Goldwasser, Michael T. Goodrich, | Data Structures and Algorithms in Python | 1118476735, 9781118476734 | John Wiley & Sons |

| | | | |
|---|---|---|---|
| **and Roberto Tamassia** | | | |
| **Rance D Necaise** | **Data Structures and Algorithms Using Python** | **9788126562169** | **John Wiley & Sons** |
| **Reference Books:** | | | |
| **Sartaj Sahni** | **DataStructures, Algorithms and applications in C++** | **Second Edition** | **Universities Press** |

**List of equipment/apparatus for laboratory experiments:**

| Sl. No. | |
|---|---|
| 1. | Computer with moderate configuration |
| 2. | Python 2.7 or higher and other softwares as required. |

**End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.**

| **Group** | **Unit** | **Objective Questions** (MCQ only with the correct answer) | | **Subjective Questions** | | | |
|---|---|---|---|---|---|---|---|
| | | No of question to be set | Total Marks | No of question to be set | To answer | Marks per question | Total Marks |
| **A** | **1 to 9** | **10** | **10** | | | | |
| **B** | **1 to 9** | | | **5** | **3** | **5** | **60** |
| **C** | **1 to 9** | | | **5** | **3** | **15** | |

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.

- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

**Examination Scheme for end semester examination:**

| Group | Chapter | Marks of each question | Question to be set | Question to be answered |
|---|---|---|---|---|
| **A** | **All** | **1** | **10** | **10** |
| **B** | **All** | **5** | **5** | **3** |
| **C** | **All** | **15** | **5** | **3** |

**Examination Scheme for Practical Sessional examination:**

**Practical Internal Sessional Continuous Evaluation**

**Internal Examination:**

| | | | |
|---|---|---|---|
| Continuous evaluation | | | **40** |

**External Examination: Examiner-**

| | | |
|---|---|---|
| Signed Lab Note Book | **10** | |
| On Spot Experiment | **40** | |
| Viva voce | **10** | **60** |

| | | | |
|---|---|---|---|
| **Name of the Course: B.Sc. in Information Technology (Big Data Analytics)**<br><br>**Subject:** Ethical Hacking & Ethical Hacking Lab | | | |
| **Course Code:** BITBDA404A & BITBDA494A | | **Semester: IV** | |
| **Duration:** 36 Hrs. | | **Maximum Marks: 100+100** | |
| **Teaching Scheme** | | **Examination Scheme** | |
| **Theory: 3 Hrs./week** | | **End Semester Exam: 70** | |
| **Tutorial:** | | **Attendance : 5** | |
| **Practical: 4 Hrs./week** | | **Continuous Assessment: 25** | |
| **Credit:3+2** | | **Practical Sessional internal continuous evaluation: 40** | |
| | | **Practical Sessional external examination: 60** | |
| **Aim:** | | | |
| **Sl. No.** | | | |
| 1. | To learn **Network Foot printing, Collect System Information, Collect Organization's information** | | |
| **Objective:** | | | |
| **Sl. No.** | | | |
| 1. | To understand Legal aspects of penetration testing | | |
| 2. | To develop Practical hacking exercise | | |
| **Pre-Requisite:** | | | |
| **Sl. No.** | | | |
| **1.** | Basic knowledge of programming | | |
| **Contents** | | **4 Hrs./week** | |
| **Chapter** | **Name of the Topic** | **Hours** | **Marks** |
| 01 | **Introduction**<br>Key issues plaguing the information security world, incident management process, and penetration testing | **2** | **5** |
| 02 | **Footprinting**<br>Various types of footprinting, footprinting tools, and Countermeasures | **2** | **5** |
| 03 | **Network Scanning and Enumeration**<br>Network scanning techniques and scanning countermeasures. Enumeration techniques and enumeration countermeasures. | **2** | **10** |
| 04 | **Attacks**<br>System hacking methodology, steganography, steganalysis attacks, and covering tracks Different types of Trojans, Trojan analysis, and Trojan Countermeasures. Working of viruses, Virus analysis, computer worms, malware analysis procedure, and countermeasures, Packet sniffing techniques and how to defend against sniffing. Social Engineering techniques, identify theft, and | **10** | **15** |

| | | | |
|---|---|---|---|
| | social engineering countermeasures. DoS/DDoS attack techniques, botnets, DDoS attack tools, and DoS/DDoS countermeasures. Session hijacking techniques and countermeasures | | |
| 05 | **Web Server Attacks**<br>Different types of web server attacks, attack methodology, and Countermeasures. SQL injection attacks and injection detection tools. Various cloud computing concepts, threats, attacks, and security techniques and tools | **8** | **15** |
| 06 | **Cryptography**<br><br>Different types of cryptography ciphers, Public Key Infrastructure (PKI), cryptography attacks, and cryptanalysis tools | **6** | **10** |
| 07 | **Penetration Testing**<br>Various types of penetration testing, security audit, vulnerability assessment, and penetration testing roadmap | **6** | **10** |
| | **Sub Total:** | **36** | **70** |
| | **Internal Assessment Examination & Preparation of Semester Examination** | **4** | **30** |
| | **Total:** | **40** | **100** |

**Practical:**
**Skills to be developed:**
Intellectual skills:

**List of Practical:**
Hand on practical based on theory paper

**Assignments:**
Based on lecture

**List of Books**
**Text Books:**

| **Name of Author** | **Title of the Book** | **Edition/ISSN/ISBN** | **Name of the Publisher** |
|---|---|---|---|
| Jon Erickson | Hacking: The Art of Exploitation | 2nd Edition | No_Starch_Press |
| **Reference Books:** | | | |
| | The_.Basics.of_.Hacking .and_.Penetration.Testi ng | | Syngress |

**End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.**

| **Group** | **Unit** | **Objective Questions** (MCQ only with the correct answer) | | **Subjective Questions** | | | |
|---|---|---|---|---|---|---|---|
| | | No of | Total | No of | To | Marks per | Total |

| | | question to be set | Marks | question to be set | answer | question | Marks |
|---|---|---|---|---|---|---|---|
| **A** | **1 to 7** | **10** | **10** | | | | |
| | | | | **5** | **3** | **5** | **60** |
| **B** | **1 to 7** | | | | | | |
| | | | | **5** | **3** | **15** | |
| **C** | **1 to 7** | | | | | | |

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

**Examination Scheme for end semester examination:**

| **Group** | **Chapter** | **Marks of each question** | **Question to be set** | **Question to be answered** |
|---|---|---|---|---|
| A | All | 1 | 10 | 10 |
| B | All | 5 | 5 | 3 |
| C | All | 15 | 5 | 3 |

**Examination Scheme for Practical Sessional examination:**

**Practical Internal Sessional Continuous Evaluation**

**Internal Examination:**

| | | | |
|---|---|---|---|
| Continuous evaluation | | | **40** |

**External Examination: Examiner-**

| | | |
|---|---|---|
| Signed Lab Note Book | **10** | |
| On Spot Experiment | **40** | |
| Viva voce | **10** | **60** |

| | | | |
|---|---|---|---|
| **Name of the Course: B.Sc. in Information Technology (Data Science)**<br>**Subject:** Neural Networks & Neural Networks Lab | | | |
| **Course Code:** BITBDA404B & BITBDA494B | | **Semester: IV** | |
| **Duration: 36** | | **Maximum Marks: 100+100** | |
| **Teaching Scheme** | | **Examination Scheme** | |
| **Theory: 3 Hrs./week** | | End Semester Exam: 70 | |
| **Tutorial: 0** | | Attendance : 5 | |
| **Practical:4 Hrs./week** | | Continuous Assessment:25 | |
| **Credit: 3+2** | | Practical Sessional internal continuous evaluation:40 | |
| | | Practical Sessional external examination:60 | |
| **Aim:** | | | |
| **Sl. No.** | | | |
| **1.** | Develop algorithms simulating human brain. | | |
| **2.** | Implement Neural Networks in Tensor Flow for solving problems. | | |
| **3.** | Explore the essentials of Deep Learning and Deep Network architectures. | | |
| **4.** | Define, train and use a Deep Neural Network for solving real world problems that require artificial Intelligence based solutions. | | |
| **Objective:** | | | |
| **Sl. No.** | | | |
| **1.** | To acquire knowledge on the basics of neural networks. | | |
| **2.** | To implement neural networks using computational tools for variety of problems. | | |
| **3.** | To explore various deep learning algorithms. | | |
| **Pre-Requisite:** | | | |
| **Sl. No.** | | | |
| 1. | Calculus, Linear Algebra | | |
| 2. | Probability & Statistics | | |
| 3. | Ability to code in R/Python | | |
| **Contents** | | **Hrs./week** | |
| **Chapter** | **Name of the Topic** | **Hours** | **Marks** |
| 01 | **Introduction**<br>Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques. | **3** | **5** |
| 02 | **Feed forward neural network**<br><br>Artificial Neural Network, activation function, multi-layer neural network,cardinality, operations, and properties of fuzzy relations. | **6** | **10** |
| 03 | **Training Neural Network**<br>Risk minimization, loss function, backpropagation, regularization, model selection, and optimization. | **6** | **15** |

| | | | |
|---|---|---|---|
| 04 | **Conditional Random Fields**<br>Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy. | **9** | **15** |
| 05 | **Deep Learning**<br>Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network. | **6** | **15** |
| 06 | **Deep Learning research**<br>Object recognition, sparse coding, computer vision, natural language | **6** | **10** |
| | **Sub Total:** | **36** | **70** |
| | **Internal Assessment Examination & Preparation of Semester Examination** | **4** | **30** |
| | **Total:** | **40** | **100** |

**Practical:**

**Skills to be developed:**

Intellectual skills:

1. Can be able to analyze relevant data.
2. Can be able to identify a solution for the problem.
3. Can be able to provide the basis for the analysis.

**List of Practical:**

Hand on Based on based on theory paper Neural Networks

**Assignments:**

Based on the curriculum as covered by subject teacher.

**List of Books**

**Text Books:**

| Name of Author | Title of the Book | Edition/ISSN/ISBN | Name of the Publisher |
|---|---|---|---|
| Goodfellow, I.,Bengio,Y., and Courville A., | Deep Learning | | MIT Press |
| Satish Kumar | Neural Networks: A Classroom Approach | | Tata McGraw-Hill |

**Reference Books:**

| | | | |
|---|---|---|---|
| Bishop, C. ,M. | Pattern Recognition and Machine Learning | | Springer |
| Yegnanarayana, B. | Artificial Neural Networks | | PHI Learning Pvt. Ltd |
| Golub, G.,H., and Van Loan,C.,F. | Matrix Computations | | JHU Press |

**List of equipment/apparatus for laboratory experiments:**

| | |
|---|---|
| Sl. No. | |
| **1.** | **Computer** |

**End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.**

| Group | Unit | Objective Questions (MCQ only with the | Subjective Questions |
|---|---|---|---|

| | | correct answer) | | | | | |
|---|---|---|---|---|---|---|---|
| | | No of question to be set | Total Marks | No of question to be set | To answer | Marks per question | Total Marks |
| **A** | **1 to 6** | **10** | **10** | | | | **60** |
| **B** | **1 to 6** | | | **5** | **3** | **5** | |
| **C** | **1 to 6** | | | **5** | **3** | **15** | |

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

**Examination Scheme for end semester examination:**

| Group | Chapter | Marks of each question | Question to be set | Question to be answered |
|---|---|---|---|---|
| **A** | **All** | **1** | **10** | **10** |
| **B** | **All** | **5** | **5** | **3** |
| **C** | **All** | **15** | **3** | **3** |

**Examination Scheme for Practical Sessional examination:**

**Practical Internal Sessional Continuous Evaluation**

**Internal Examination:**

| | | | |
|---|---|---|---|
| Continuous evaluation | | | **40** |

**External Examination: Examiner-**

| | | |
|---|---|---|
| Signed Lab Note Book | **10** | |
| On Spot Experiment | **40** | |
| Viva voce | **10** | **60** |

| | |
|---|---|
| **Name of the Course: B.Sc. in Information Technology (Big Data Analytics)**<br><br>**Subject:** Optimisation Techniques & Optimisation Techniques Lab | |
| **Course Code: BITDS404C**<br>**BITDS494C** | **Semester: IV** |
| **Duration: 36 Hrs.** | **Maximum Marks: 100+100** |
| **Teaching Scheme** | **Examination Scheme** |
| **Theory: 3 Hrs./week** | End Semester Exam: 70 |
| **Tutorial: 0** | Attendance : 5 |
| **Practical:4 Hrs./week** | Continuous Assessment:25 |
| **Credit: 3+2** | Practical Sessional internal continuous evaluation:40 |
| | Practical Sessional external examination:60 |

**Aim:**

| **Sl. No.** | |
|---|---|
| **1.** | **The aim of this course is to provide a basic understanding of the** Optimisation **Techniques** |
| | |

**Objective:**

| **Sl. No.** | |
|---|---|
| **1.** | **To impart knowledge in concepts and tools of Operations Research** |
| **2.** | **To understand mathematical models used in Operations Research** |
| **3.** | **To apply these techniques constructively to make effective business decisions** |

**Pre-Requisite:**

| **Sl. No.** | |
|---|---|
| **1.** | Strong mathematical background. |

| | |
|---|---|
| | And the ability to understand new mathematical concept as needed. |

| **Contents** | | **Hrs./week** | |
|---|---|---|---|
| **Chapter** | **Name of the Topic** | **Hours** | **Marks** |
| 01 | **Introduction to Operation Research:** Operation Research approach, scientific methods, introduction to models and modeling techniques, general methods for Operation Research models, methodology and advantages of Operation Research, history of Operation Research. | **2** | **5** |
| 02 | **Linear Programming (LP):** Introduction to LP and formulation of Linear Programming problems, Graphical solution method, alternative or multiple optimal solutions, Unbounded solutions, Infeasible solutions, Maximization – Simplex Algorithm, Minimization – Simplex Algorithm using Big-M method, Two phase method, Duality in linear programming, Integer linear programming. | **5** | **10** |
| 03 | **Transportation & Assignment Problems:** Introduction to Transportation problems, various methods of Transportation problem, Variations in Transportation problem, introduction to Assignment problems, variations in Assignment problems. | **4** | **10** |
| 04 | **Network Analysis:** Network definition and Network diagram, probability in PERT analysis, project time cost trade off, introduction to resource smoothing and allocation. | **4** | **10** |
| 05 | **Sequencing:** Introduction, processing N jobs through two machines, processing N jobs through three machines, processing N jobs through m machines. | **4** | **5** |
| 06 | **Inventory Model:** Introduction to inventory control, deterministic inventory model, EOQ model with quantity discount. | **4** | **5** |
| 07 | **Queuing Models:** Concepts relating to queuing systems, basic elements of queuing model, role of Poison & exponential distribution, concepts of birth and death | **5** | **10** |

| | | | |
|---|---|---|---|
| | process. | | |
| 08 | **Replacement & Maintenance Models:** Replacement of items, subject to deterioration of items subject to random failure group vs. individual replacement policies. | **4** | **5** |
| 09 | **Simulation:** Introduction & steps of simulation method, distribution functions and random number generation. | **4** | **10** |
| | **Sub Total:** | **36** | **70** |
| | **Internal Assessment Examination & Preparation of Semester Examination** | **4** | **30** |
| | **Total:** | **40** | **100** |

**List of equipment/apparatus for laboratory experiments:**

| Sl. No. | |
|---|---|
| 1. | **Computer** |

**Practical:**

**Skills to be developed:**

Intellectual skills:

**List of Practical:**

Hand on experiments based on theory paper

**Assignments:**

Based on the curriculum as covered by subject teacher.

**List of Books**

**Text Books:**

| Name of Author | Title of the Book | Edition/ISSN/ISBN | Name of the Publisher |
|---|---|---|---|
| J K Sharma | Operations Research Theory and Applications | | MacMillan India Ltd |

| | | | |
|---|---|---|---|
| N D Vohra | Quantitative Techniques in management | | Tata McGraw Hill |
| **Reference Books:** | | | |
| Handy A Taha | Operations Research – An Introduction | | Prentice Hall of India, New Delhi. |
| Wagner H M | Principles of Operations Research: With Applications to Management Decisions | | Prentice-Hall of India, New Delhi. |
| Hillier F S and Lieberman G J | Operations Research | | Holden Day Inc., San Francisco |
| Payne T A | Quantitative Techniques for Management: A Practical Approach | | Reston Publishing Co. Inc., Virginia. |

**End Semester Examination Scheme.** **Maximum Marks-70.** **Time allotted-3hrs.**

| **Group** | **Unit** | **Objective Questions** (MCQ only with the correct answer) | | **Subjective Questions** | | | |
|---|---|---|---|---|---|---|---|
| | | No of question to be set | Total Marks | No of question to be set | To answer | Marks per question | Total Marks |
| **A** | **1 to 9** | **10** | **10** | | | | **60** |
| **B** | **1 to 9** | | | **5** | **3** | **5** | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **C** | **1 to 9** | | | **5** | **3** | **15** | |

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

**Examination Scheme for end semester examination:**

| **Group** | **Chapter** | **Marks of each question** | **Question to be set** | **Question to be answered** |
|---|---|---|---|---|
| **A** | **All** | **1** | **10** | **10** |
| **B** | **All** | **5** | **5** | **3** |
| **C** | **All** | **15** | **3** | **3** |

**Examination Scheme for end semester examination:**

| **Group** | **Chapter** | **Marks of each question** | **Question to be set** | **Question to be answered** |
|---|---|---|---|---|
| A | All | 1 | 10 | 10 |
| B | All | 5 | 5 | 3 |
| C | All | 15 | 5 | 3 |

**Examination Scheme for Practical Sessional examination:**

**Practical Internal Sessional Continuous Evaluation**

**Internal Examination:**

| | | | |
|---|---|---|---|
| Continuous evaluation | | | **40** |

**External Examination: Examiner-**

| | | |
|---|---|---|
| Signed Lab Assignments | **10** | |
| On Spot Experiment | **40** | |
| Viva voce | **10** | **60** |

| | | | |
|---|---|---|---|
| **Name of the Course: B.Sc. in Information Technology (Big Data Analytics)**<br>**Subject:** Social Media Mining & Social Media Mining Lab | | | |
| **Course Code: :** BITBDA404D & BITBDA494D | | **Semester: IV** | |
| **Duration: 36 Hrs.** | | **Maximum Marks: 100+100** | |
| **Teaching Scheme** | | **Examination Scheme** | |
| **Theory: 3 Hrs./week** | | End Semester Exam: 70 | |
| **Tutorial: 0** | | Attendance : 5 | |
| **Practical:4 Hrs./week** | | Continuous Assessment:25 | |
| **Credit: 3+2** | | Practical Sessional internal continuous evaluation:40 | |
| | | Practical Sessional external examination: 60 | |
| **Aim:** | | | |
| **Sl. No.** | | | |
| 1. | To provides students a hands-on introduction to scalable graph mining | | |
| 2. | Data analysis on social networks | | |
| 3. | Focusing on ways to handle large-scale networks efficiently | | |
| **Objective:** | | | |
| **Sl. No.** | | | |
| **1.** | Understand the basic concepts of social networks | | |
| **2.** | Understand the fundamental concepts in analyzing the large-scale data that are derived from social networks | | |
| **3.** | Implement mining algorithms for social networks | | |
| **4.** | Perform mining on large social networks and illustrate the results. | | |
| **Pre-Requisite:** | | | |
| **Sl. No.** | | | |
| **1.** | The students should have a basic algorithmic and programming background | | |
| **2.** | basic knowledge in the fields of graph theory | | |
| **Contents** | | **Hrs./week** | |
| **Chapter** | **Name of the Topic** | **Hours** | **Marks** |
| 01 | **Introduction to Social Network Mining, Graph Models and Node Metrics**<br>Introduction to social network mining. Illustration of various social network mining tasks with real-world examples. Data characteristics unique to these settings and potential biases due to them. Social Networks as Graphs. Random graph models/ graph generators (Erd¨os-R´enyi, power law, preferential attachment, small world, stochastic block models, kronecker graphs), degree distributions. Models of evolving networks. Node based metrics, ranking algorithms (Pagerank). Gephi graph visualization and exploration software – practice. | **8** | **15** |
| 02 | **Social-Network Graph Analysis**<br>Social network exploration/ processing: graph kernels, graph classification, clustering of social-network graphs, centrality measures, community detection and mining, degeneracy (outlier detection and centrality), partitioning of graphs. SNAP system for | **6** | **10** |

| | | | |
|---|---|---|---|
| | large networks analysis and manipulation. | | |
| 03 | **Social-Network Graph Analysis and Properties**<br>Social network exploration/ processing and properties: Finding overlapping communities, similarity between graph nodes, counting triangles in graphs, neighborhood properties of graphs. Pregel paradigm and Apache Giraph graph processing system. | **8** | **15** |
| 04 | **Information Diffusion in Social Networks**<br>Strategic network formation: game theoretic models for network creation/ user behavior in social networks. Information diffusion in graphs: Cascading behavior, spreading, epidemics, heterogeneous social network mining, influence maximization, outbreak detection. Opinion analysis on social networks: Contagion, opinion formation, coordination and cooperation. | **8** | **15** |
| 05 | **Dynamic Social Networks, Applications and Research Trends**<br>Dynamic social networks, Link prediction, Social learning on networks. Special issues in Information and Biological networks. Important applications of social network mining related to the above topics. Research trends. | **6** | **15** |
| | **Sub Total:** | **36** | **70** |
| | **Internal Assessment Examination & Preparation of Semester Examination** | **4** | **30** |
| | **Total:** | **40** | **100** |

**List of equipment/apparatus for laboratory experiments:**

| Sl. No. | |
|---|---|
| 1. | **Computer** |

**Practical:**

**Skills to be developed:**
Intellectual skills:
Students will be able to

1. Apply data mining techniques in social media.
2. Analyze and mine emotions in social media.
3. Classify communities in social media.
4. Apply the social media mining concepts to real world situations and derive useful Knowledge.
5. Infer the challenges in social media mining.
6. Predict the significance of social media and its impact in the real time scenarios.

**List of Practical:**

Hand on experiments based on theory paper

**Assignments:**
Based on the curriculum as covered by subject teacher.

**List of Books**
**Text Books:**

| Name of Author | Title of the Book | Edition/ISSN/ISBN | Name of the Publisher |
|---|---|---|---|
| David Easley and Jon Kleinberg | Networks, crowds, and markets | | Cambridge University Press |
| **Reference Books:** | | | |
| Jure Leskovec, Anand Rajaraman and Jeffrey David Ullman | Mining of massive datasets | | Cambridge University Press |
| | | | |

**List of equipment/apparatus for laboratory experiments:**

| Sl. No. | |
|---|---|
| 2. | **Computer** |

**End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.**

| Group | Unit | Objective Questions (MCQ only with the correct answer) | | Subjective Questions | | | |
|---|---|---|---|---|---|---|---|
| | | No of question to be set | Total Marks | No of question to be set | To answer | Marks per question | Total Marks |
| **A** | **1 to 5** | **10** | **10** | | | | **60** |
| **B** | **1 to 5** | | | **5** | **3** | **5** | |
| **C** | **1 to 5** | | | **5** | **3** | **15** | |

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

**Examination Scheme for end semester examination:**

| Group | Chapter | Marks of each question | Question to be set | Question to be answered |
|---|---|---|---|---|
| **A** | **All** | **1** | **10** | **10** |
| **B** | **All** | **5** | **5** | **3** |
| **C** | **All** | **15** | **3** | **3** |

**Examination Scheme for Practical Sessional examination:**

**Practical Internal Sessional Continuous Evaluation**

| | | | |
|---|---|---|---|
| **Internal Examination:** | | | |
| Continuous evaluation | | | **40** |
| **External Examination: Examiner-** | | | |
| Signed Lab Assignments | | **10** | |
| On Spot Experiment | | **40** | |
| Viva voce | | **10** | **60** |

| | |
|---|---|
| **Name of the Course: B.Sc. in Information Technology (Big Data Analytics)**<br>**Subject:** Technical Seminar and Communication Skill | |
| **Course Code:** BITBDA481 | **Semester: IV** |
| **Duration:** 12 Hrs. | **Maximum Marks: 100** |
| **Teaching Scheme** | **Examination Scheme** |
| **Theory: 0** | **End Semester Exam: 100** |
| **Tutorial: 0** | **Attendance: 0** |
| **Practical: 2 hrs./week** | **Continuous Assessment: 0** |
| **Credit: 1** | **Practical Sessional internal continuous evaluation: NA** |
| | **Practical Sessional external examination: NA** |
| **Contents** | |
| Students will give technical seminar and improve their communication skill. | |

| | |
|---|---|
| **Name of the Course: B.Sc. in Information Technology (Big Data Analytics)**<br><br>**Subject:** Project II | |
| **Course Code:** BITBDA482 | **Semester: IV** |
| **Duration:** 36 Hrs. | **Maximum Marks: 100** |
| **Teaching Scheme** | **Examination Scheme** |
| **Theory: 0** | **End Semester Exam: 100** |
| **Tutorial: 0** | **Attendance: 0** |
| **Practical: 2 hrs./week** | **Continuous Assessment: 0** |
| **Credit: 1** | **Practical Sessional internal continuous evaluation: 40** |
| | **Practical Sessional external examination: 60** |
| **Contents** | |
| Students will do projects on application areas of latest technologies and current topics of societal relevance. | |