RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B.TECH.) DEGREE COURSE
SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: INFORMATION TECHNOLOGY

Subject : **Data Warehousing & Mining** **Subject Code :** **BTIT701T**

Load	Credit	Total Marks	Internal Marks	University Marks	Total
3Hrs (Theory) 1 Hrs (Tutorial)	04	100	30	70	100

Aim : To understand the basic concept of various data warehousing and mining algorithms.

Prerequisite(s): DBMS

Course Objective/Learning Objective:

1	To understand data warehouse concepts, architecture, business analysis and tools.
2	To understand data pre-processing methods and data techniques.
3	To be familiar with the OLAP models & Tools.
4	To know the Architecture of a Data Mining system and algorithms for finding hidden and interesting patterns in data.
5	To understand and study frequent Item sets of data mining and various kinds of Association Rules and Algorithms.

Course Outcome:

At the end of this course Student are able to:

CO1	Design a Data Mart, Schema and Data Warehouse for any organization.
CO2	Solve basic statistical calculations on data and describe the aspect of Data Pre-processing.
CO3	Apply fundamental knowledge of Multidimensional Schemes suitable for data warehousing.
CO4	Analyze various data mining functionalities and Apply the concept of data mining algorithms and technique for designing data mining systems
CO5	Illustrate fundamental concept of frequent Item sets, Closed Items sets of data mining and various kinds of Association Rules.

UNIT I:

Introduction to Data Warehousing:

What is Data Warehousing?, Operational v/s decision support systems, Data warehousing Architecture, Data Warehouse Models, Metadata Repository, Data Marts and Metadata, Data warehouses versus Data Marts.

UNIT II:

Data Preprocessing:

Why preprocess the data?, Major Tasks in data preprocessing, Descriptive data summarization, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT III:

OLAP Analytical Processing:

Data Cube, Multidimensional Data Model, Schemas for Multidimensional Data Model, Concept Hierarchies, Measures, OLAP Operations, Data Cube Computations, OLAP Servers, major, OLAP models- ROLAP, MOLAP, HOLAP.

UNIT IV:

Introduction of Data Mining:

Why Data Mining, What is Data Mining, Data Mining functionalities, Interesting Patterns, Data Mining techniques from many domains, Architecture, Classification of Data Mining, Applications of Data Mining, Major issues in Data Mining.

UNIT V:

Mining Frequent Patterns and Association Rules:

Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rule, Frequent Itemset Mining Methods: Apriori Algorithm, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, FP growth, Mining Frequent Itemsets using Vertical Data Format.

Textbooks:

- Data Mining (Concepts and Techniques) - Han and Kamber.
- Data Mining and Business Intelligence - Shinde and Chandrashekhar, Dreamtech Press.
- Professional Hadoop Solutions - Lublinsky, Smith, Yakubovich, Wiley.

References:

- Introduction to Data Mining – Tan, Steinbach, Vipin Kumar, Pearson Education.
- Fundamentals of Data Warehouses, Jarke, Vassiliou, 2nd Edition, Springer.
- Data Warehousing in Real World - Anahory, Murray, Pearson Education
- Data Warehousing – Paulraj Ponniah.

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BRANCH: INFORMATION TECHNOLOGY

Subject: DATA WAREHOUSING & MINING **Subject Code: BTIT701P**

Load	Credits	Internal Marks	University Marks	Total Marks
02 Hrs (Practical)	01	25	25	50

Aim: To Design data warehouse, schemas & learn various algorithm of data mining.

Prerequisite(s):

Student should have a basic understanding of Data Base Management System. A basic knowledge of Python the programming languages. A basic knowledge of open source Tools.

Course Objectives:

1	Learn how to build a data warehouse, query and schema. (Using any one open source tools)
2	Understand the concept of data preprocessing on data sets.
3	Demonstrate the working of algorithms for data mining tasks such association rule.

Course Outcomes:

At the end of this course Student are able to:

CO1	Apply fundamental concept of Weka Tool and data mining techniques.
CO2	Apply basic concept of data preprocessing an evaluate operations for Numerical Data.
CO3	Apply and execute the classification rule for various algorithms.
CO4	Analyze and apply Association rules on data set, evaluate the efficiency of algorithm.

NOTE:

1. Practical's are based on Data Warehousing & Mining Syllabus
2. Practical's have to be performed using 'Python' language / Any open source Tools like WEKA
3. There should be at the most two practical's per unit
4. Minimum ten practical's have to be performed

PRACTICALS CAN BE BASED ON FOLLOWING TOPICS: (For Weka open Tool) IF Conducted in Python then not limited to following topics.

Topic 1: Preprocess

Topic 2: Classify

Topic 3: Cluster

Topic 4: Associate

Topic 5: Select Attributes

Topic 6: Visualize

Topic 7: Decision Tree

Topic 8: Cloudera / Teradata / Oracle/ TabLeau (Data Warehouse Tools)

Topic 9 : WEKA /Orange

Topic 10 : KNIME / R-Programming.

Textbooks:

- Data Mining (Concepts and Techniques) - Han and Kamber.
- Data Mining and Business Intelligence - Shinde and Chandrashekhar, Dreamtech Press.
- Professional Hadoop Solutions - Lublinsky, Smith, Yakubovich, Wiley.
- Head-First Python, 2nd edition Paul Barry(O'Reilly, 2016)
- Invent Your Own Computer Games with Python, 4th edition AI Sweigart.
- Introduction to Data Mining – Tan, Steinbach, Vipin Kumar, Pearson Education.
- Fundamentals of Data Warehouses, Jarke, Vassiliou, 2nd Edition, Springer.

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BRANCH: INFORMATION TECHNOLOGY

Subject : Elective-IV Deep Learning **Subject Code : BTIT702T.1**

Load	Credit	Total Marks	Internal Marks	University Marks
03Hrs (Theory)	03	100	30	70

Course Objectives:

1. To introduce basic deep learning algorithms.
2. To understand real world problem which will be solved by deep learning methods.
3. To identify deep learning techniques suitable for a real world problem.

Course Outcomes:
On successful completion of the course, students will be able to:

1. Understand basic of deep learning algorithms.
2. Represent feed forward Neural Network
3. Evaluate the performance of different deep learning models with respect to the optimization, bias variance trade-off, over fitting and under fitting.
4. Apply the convolution networks in context with real world problem solving.
5. Apply recurrent neural networks in context with real world problem solving.

UNIT I **(06 Hrs)**

Basic of Deep Learning - History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm and Convergence, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed forward Neural Networks.

UNIT II **(06 Hrs)**

Training of feed forward Neural Network - Representation Power of Feed forward Neural Networks, Training of feed forward neural network, Gradient Descent, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam.

UNIT III **(06 Hrs)**

Optimization Algorithm - Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Activation Function and Initialization Methods: Sigmoid, Tanh, Relu, Xavier and He initialization, Regularization: Bias and variance, Overfitting, Hyperparameters tuning, L1 and L2 regualarization, Data Augmentation and early stopping, Parameter sharing and tying.

UNIT IV **(06 Hrs)**

Convolution Neural Network (CNN) - Convolutional operation, Pooling, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Visualizing Convolutional Neural Networks, Guided Backpropagation.

UNIT V **(06 Hrs)**

Recurrent Neural Network (RNN) - Recurrent Neural Networks, Backpropagation through Time (BPTT), Vanishing and Exploding Gradients, Long Short Term Memory (LSTM) Cells, Gated Recurrent Units (GRUs).

Text Books:

1. Sandro Skansi, Introduction to Deep Learning ,Springer.
2. Charu C. , Aggarwal. Neural Networks and Deep Learning: A Textbook. Springer. 2019.
3. Ian Goodfellow , Yoshua Bengio and Aaron Courville. Deep Learning. An MIT Press book. 2016.
4. Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr.D Karthika Renuka ,Deep Learning using Python,Willey Publication.

Reference Books:

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. A. Ravindran, K. M. Ragsdell , and G. V. Reklaitis, Engineering Optimization: Methods and Applications , John Wiley & Sons, Inc. , 2016.

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BRANCH: INFORMATION TECHNOLOGY

Subject : Elective-IV Cryptography & Network Security **Subject Code : BTIT702T.2**

Load	Credit	Total Marks	Internal Marks	University Marks
03Hrs (Theory)	03	100	30	70

Course Objectives :

1. To develop the student's ability to understand the concept of security goals in various applications and learn classical encryption techniques.
2. To apply fundamental knowledge on cryptographic mathematics used in various symmetric and asymmetric key cryptography.
3. To develop the student's ability to analyze the cryptographic algorithms.
4. To develop the student's ability to analyze the cryptographic algorithms.

Course Outcomes:

1. To understand basics of Cryptography and Network Security and classify the symmetric encryption techniques.
2. Understand, analyze and implement the symmetric key algorithm for secure transmission of data.
3. To Acquire fundamental knowledge about the background of mathematics of asymmetric key cryptography and understand and analyze asymmetric key encryption algorithms and digital signatures.
4. Analyze the concept of message integrity and the algorithms for checking the integrity of data.
5. To understand various protocols for network security to protect against the threats in the networks.

Unit I

Introduction : Attributes of security, OSI Security Architecture, Model for network security. Mathematics of cryptography: modular arithmetic, Euclidean and extended Euclidean algorithm. Classical encryption techniques: substitution techniques-Caesar cipher,Vigenere's ciphers, Hill ciphers, Playfair ciphers and transposition techniques.

Unit II

Symmetric key cryptography: Block Cipher Principles, Data Encryption Standard (DES), Triple DES, Advanced Encryption Standard (AES), RC4, Key Distribution.

Unit III

Asymmetric key cryptography: Euler's Totient Function, Fermat's and Euler's Theorem, Chinese Remainder Theorem, RSA, Diffie Hellman Key Exchange, ECC, Entity authentication: Digital signature.

Unit IV

Message Integrity and authentication: Authentication Requirements and Functions, Hash Functions, MD5, Kerberos, Key Management, X.509 Digital Certificate format.

Unit V

Network Security: PGP, SSL, Firewalls, IDS, Software Vulnerability: Phishing, Buffer Overflow, SQL Injection, Electronic Payment Types,

Text Books:

1. William Stallings,"Cryptography and Network Security: Principles and Standards", Prentice Hall India, 7th Edition, 2017.
2. Bernard Menezes, "Network Security and Cryptography", Cengage Learning, 2010.

References:

1. Nina Godbole, "Information System Security", Wiley India Publication, 2008.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network security, private communication in a public world", Second Edition, Prentice Hall, 2002.
3. Christopher M. King, Curtis Patton and RSA press, "Security architecture, Design Deployment and Operations", McGraw Hill Publication, 2001.
4. Robert Bragge, Mark Rhodes, Heithstraggberg "Network Security, The Complete Reference", Tata McGraw Hill Publication, 2004.
5. Behrouz A. Forouzan, "Cryptography and Network Security", McGraw-Hill publication, 2nd Edition, 2010.

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BRANCH: INFORMATION TECHNOLOGY

Subject : Elective-IV Compiler Design **Subject Code : BTIT702T.3**

Load	Credit	Total Marks	Internal Marks	University Marks	Total
3 Hrs (Theory)	3	100	30	70	100

Aim: To understand the principles and concepts of Compiler Design.

Prerequisite(s): Students should have the knowledge of computers and mathematics.

Course Objectives:

1	Define the different phases of the Compiler and utilities of Automata.
2	Understand the concept of syntax and semantic Analysis.
3	Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.
4	Understand the Architecture of computer and its use in designing a compiler.

Course Outcomes: At the end of this course students are able to:

CO1	Define the compiler along with the phases and basic program in LEX
CO2	Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of parsing table.
CO3	Implement program based on concept of type checking, parameter passing and Overloading.
CO4	Implement the concept of Code Optimizations and Code Generations.
CO5	Understand the concepts of Object Oriented in Compilers.

Unit I:

Introduction: Phases of compilation and over view, Lexical Analysis(Scanner),Regular languages, finite automata, regular expression, relating regular expression and finite automata, scanner generator (lex, flex) [07 Hours]

Unit II:

Syntax Analysis (Parser): push-down automata, and top-down parsing, bottom up parsing, ambiguity and parser generator (yacc, bison) [07 Hours]

Unit III:

Semantic Analysis: Attribute Grammar, syntax directed definition, evaluation, and flow of attribute in a syntax tree, Symbol Table: Basic Structure, symbol table attributes and managements, Runtime Environment: Procedure activation, parameter passing, value return, memory allocation [08 Hours]

Unit IV:

Intermediate Code Generation: Translation of different language features, different types of intermediate forms, code improvement (optimization), control flow, data dependence etc, local optimization, global optimization, peephole optimization etc. [07 Hours]

Unit V:

Architecture dependent code improvement: instruction scheduling (for pipelining), loop optimization (for cache memory), Register allocation and target code generation. [07 Hours]

Text Books:

1. Compilers: Principles, Techniques and Tools, V. Aho,R. Sethi, J.Ullman.
2. Lex and Yaac, Levine R. John, Tony Mason and Doug Brown.

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BRANCH: INFORMATION TECHNOLOGY

Subject : Elective-IV Salesforce **Subject Code : BTIT702T.4**

Load	Credit	Total Marks	Internal Marks	University Marks	Total
3 Hrs (Theory)	3	100	30	70	100

Aim: To provide a comprehensive understanding of the Salesforce platform, its core features, and its various components.

Prerequisite(s): OOPS (Object Oriented Programming) or any programming language

Course Objectives:

1	To make learn how to create and customize objects, fields, and records; building workflows and automation processes.
2	To learn designing and managing reports and dashboards; and utilizing the Salesforce AppExchange.
3	To provide knowledge and hands-on experience in programming using Apex (Salesforce's proprietary programming language)

Course Outcomes: At the end of this course students are able to:

CO1	Develop skills in configuring and managing Salesforce orgs.
CO2	Understanding Salesforce Data Management
CO3	Implementing automation, security and debugging data.
CO4	Acquire programming skills in Apex, Salesforce's programming language.
CO5	Enable to extend and customize Salesforce to meet specific business quirements.

Unit I: [07 Hours]

Salesforce Administration:- INTRODUCTION TO SALESFORCE:- Cloud Computing ,Services of Cloud computing, Types of Cloud, What is Salesforce? ,Salesforce Products, How to create Salesforce developer edition account, Walkthrough Salesforce.com platform.

CONFIGURATION AND CUSTOMIZATION:- Salesforce: Data types, field types and components, Apps in Salesforce(Standard Apps,Custom Apps),Steps to Create a Salesforce App, Salesforce tabs,Types of Tab Visibility.Users & User Licenses, Salesforce Objects, fields & Field Dependency, Profiles & Roles

Unit II: [07 Hours]

Relationships In Salesforce, Validation Rule & formula , Approval process , Flows and Process Builder, Page Layouts, Reports and Dashboards, WorkFlow: Define Workflow, Workflow Rules, Components of Workflow (action , criteria),How to configure Workflow Rule Criteria?, Setup workflow tasks & Email Alerts & Field Updates, Time dependent workflows.

Unit III: [08 Hours]

AUTHORIZATION & SHARING DATA:-

Profiles, Permission Sets, Org-Wide Defaults , Role Hierarchies, Sharing Rules , Manual Sharing , Record Types, DATA MANAGEMENT :- Import and Export Data, Data Loader.

Unit IV: [07 Hours]

INTRODUCTION TO APEX:- Collections (List, Map, Set), DML Operations, SOQL And SOSL, Controllers In APEX, Apex Triggers: Overview On Triggers, Trigger Events: Before Triggers, After Triggers, Insert Triggers, Update Triggers, Delete Triggers, Undelete Triggers, Trigger context variables, Recursive Triggers, Governor Limits.

Unit V: [07 Hours]

ASYNCHRONOUS APEX : Future Method, Queueable Apex, Scheduled Apex, Batch APEX: Iterable Class, QueryLocator, GetQueryLocator, Start Method, Execute Method, Finish Mehtod, BatchableContext, Test Class: StartTest, StopTest, Test Class on Apex class and TriggersText .

Text Books:

1. "Salesforce Platform App Builder Certification Handbook" by Siddhesh Kabe and Muhammad Ehsan Khan (Packt Publishing).
2. "Salesforce CRM: The Definitive Admin Handbook" by Paul Goodey (Packt Publishing).
3. "Force.com Enterprise Architecture" by Andrew Fawcett (Packt Publishing).
4. "Mastering Salesforce CRM Administration" by Rakesh Gupta (Packt Publishing).
5. "Salesforce Essentials for Administrators" by Mohith Shrivastava (Packt Publishing).
6. "Learning Salesforce Lightning Application Development" by Mohith Shrivastava (Packt Publishing).
7. "Apex Design Patterns" by Jitendra Zaa (Packt Publishing).
8. "Mastering Apex Programming" by Chamil Madusanka (Packt Publishing).

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SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: INFORMATION TECHNOLOGY

Subject : Elective-V Natural Language Processing **Subject Code : BTIT703T.1**

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03Hrs (Theory)	03	100	30	70	100

Course Objective/Learning Objective:

1	To introduce the basic concepts and applications of Natural Language Processing (NLP)
2	To provide an understanding of the challenges in NLP and their solutions
3	To teach the different techniques and algorithms used in NLP, such as text classification, information retrieval and extraction, syntactic and semantic analysis, and deep learning models
4	To enable students to analyze text data and build NLP models
5	To equip students with the skills to evaluate and compare different NLP techniques and algorithms

Course Outcome:

At the end of this course Student are able to:

CO1	Understand the basic concepts and applications of Natural Language Processing (NLP)
CO2	Identify the challenges in NLP and evaluate the solutions to these challenges
CO3	Analyze and preprocess text data for NLP tasks
CO4	Apply different NLP techniques and algorithms such as text classification, information retrieval and extraction, syntactic and semantic analysis, and deep learning models
CO5	Evaluate and compare different NLP techniques and algorithms using appropriate metrics

UNIT I: **(08Hrs)**

Introduction to NLP: Definition and scope of NLP, Historical overview and applications of NLP, Challenges in NLP and their solutions, Basic concepts in linguistics and language processing, Text preprocessing and normalization.

UNIT II: **(07 Hrs)**

Language Models and Text Classification: Language modeling and n-gram models, Classification and categorization of text data, Text classification algorithms such as Naive Bayes, Decision Trees, and Support Vector Machines (SVM), Evaluation measures for text classification.

UNIT III: **(07 Hrs)**

Information Retrieval and Extraction: Information retrieval models such as vector space model and probabilistic model, Retrieval of relevant documents using query expansion, Named Entity Recognition (NER), Relation Extraction and Open Information Extraction (OIE)

UNIT IV: **(07 Hrs)**

Syntactic and Semantic Analysis: Parts of Speech (POS) tagging and parsing, Dependency Parsing, Semantic Analysis and Sentiment Analysis, Word Embeddings and Semantic Similarity

UNIT V: **(07 Hrs)**

Advanced Topics in NLP: Neural Network models for NLP tasks , Deep Learning models for NLP tasks, Natural Language Generation (NLG), Dialogue Systems and Chatbots.

Textbooks:

- Speech and Language Processing" by Daniel Jurafsky and James H. Martin
- Natural Language Processing" by Jacob Eisenstein

References:

- "Foundations of Statistical Natural Language Processing" by Christopher D. Manning and HinrichSchütze
- "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper

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SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: INFORMATION TECHNOLOGY

Subject : Elective-V Big Data Analytics **Subject Code : BTIT703T.2**

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03Hrs (Theory)	03	100	30	70	100

Pre- requisites : Should have knowledge of Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

Course Objective/Learning Objective:

1	Student should able to learn and understandthe basic concept, characteristics andapplication of Big Data.
2	To learn Concept of Distributed system withApache Hadoop.
3	To learn application of Hadoop to solve realworld problem

Course Outcome:

At the end of this course Student are able to:

CO1	Understand Concept, characteristics, types of big data
CO2	.Build and maintain reliable, scalable, distributed systems with Apache Hadoop.
CO3	Apply Hadoop ecosystem components to solve real world problems.
CO4	Apply machine learning algorithm for big data analysis.
CO5	Implement Big Data Activities using Hive

UNIT I : Introduction to Big Data: Data, Characteristics of data and Types of digital data: Unstructured, Semi-structured andStructured, Sources of data, working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data, Data environment versus big data environment, Big Data Analysis Life Cycle.

UNIT II :

Big data analytics tools and Technologies: Overview of business intelligence, Characteristics and need of big data analytics, Classification of analytics, Challenges to big data analytics. Analytical operations: Associations rules, classifications, clustering, Mahout ML, etc.

UNIT III :

Hadoop foundation for analytics: Features, Hadoop ecosystems, Evolution of Hadoop architectures Hadoop 1.0, Hadoop 2.0, Hadoop3.0, Key aspects and Components of Hadoop 3.0. Hadoop Technology Stack: Hive, Pig, Zookeeper, Swoop, oozie, flume, etc.

Unit IV :

MapReduce and YARN framework: Introduction to MapReduce, Processing data with MapReduce, Introduction to YARN, Components YARN, Data serialization and Working with common serialization formats, Big data serialization formats

UNIT V :

NoSQL Databases: Schema-less Models, Increasing Flexibility for Data ManipulationKey Value Stores- Document Stores – Tabular Stores – Object Data Stores Hive – Sharding —Hbase – Analyzing big data NoSQL Database Architectures.

Text Books :

1) Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2) Seema Acharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015.
3) Big Data,Big Data Analytics by Michael Minelli, Michele Chambers, AmbigaDhira
4) David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.

References

1) Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2) Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013).

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SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: INFORMATION TECHNOLOGY

Subject : Mobile Computing **Subject Code : BTIT703T.3**

Load	Credit	Internal Marks	University Marks	Total
03 Hr	03	30	70	100

Pre- requisites : Computer Networks, TCP/IP, Data Communication.

Course Objective/Learning Objective:

1	To study Wireless Communication with Cellular system Model.
2	To study GSM system with Radio, Network Switching and Operation subsystem.
3	To learn Wireless LAN with MAC Layer.
4	To study Mobile MANET with WAP protocol.

Course Outcome:

At the end of this course Student are able :

CO1	To Understand the basic concepts of Wireless Communication with Cellular system.
CO2	To learn about GSM System with Cell layout, Radio, Network Switching and Operation subsystem, HLR & VLR.
CO3	To learn Wireless LAN with its Architecture and MAC Layer.
CO4	To learn Mobile IP, Dynamic Host Configuration Protocol, Mobile Ad hoc Networks.
CO5	To learn about TCP over Wireless Networks. with Wireless Application protocol.

UNIT I :

Introduction to Mobile Computing, Features of Wireless Communication, Applications of Wireless Communication, A simplified Reference Model in Mobile Computing, Cellular system Infrastructure with generic Block diagram, frequency reuse, Medium Access Control (Wireless):Motivation for a specialized MAC, Hidden and exposed terminals, near and far terminals, Wireless Network over Wired Network.

UNIT II :

Introduction to GSM system: Mobile Services, GSM Architecture, GSM operational and technical requirements. Cell layout and frequency planning, GSM radio subsystem, Network and Switching Subsystem, Operation subsystem. Echo canceller, Localization and calling, Handovers.

UNIT III :

Wireless LAN: Advantages of Wireless LAN, Applications, IEEE 802.11 standards, system Architecture, protocol architecture, physical layer, medium access control layer, MAC management, Mobile Agents, Requirement for mobile agent system, Bluetooth, Roaming.

UNIT IV :

Mobile Network Layer: Mobile IP-IP Packet delivery, Dynamic Host Configuration Protocol(DHCP), Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, Routing, DSDV, DSR, AODV& Hybrid Routing Protocol.

UNIT V :

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Selective retransmission, Transaction oriented TCP, Wireless Application Protocol (WAP), Architecture, Wireless datagram protocol.

Text Books :

1. Mobile Communications, Jochen Schiller, Second edition, Pearson,2006.
2. Mobile Computing for beginners, Raksha Shende, Arizona Business Alliance, 2012.
3. Wireless Communication- Principles and Practice, 2nd Edition, Theodore S. Rappaport, PHI Publications.
4. Mobile Computing- Theory and Practice, Kumar Garg, Pearson Publications

References :

1. Fundamentals of Mobile and Pervasive Computing, Adelstein, Frank, Gupta and Sandeep KS, McGraw-Hill, 2005.
2. Mobile Communication, T. Shivakami, Annaji M. Kuthe, Scientific International Publishing House, 2022.

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BRANCH: INFORMATION TECHNOLOGY

Open Elective-II Python Programming
Subject Code : BTIT704T.1

Load	Credit	Internal Marks	University Marks	Total
03Hrs	03	30	70	100

Course Objectives :

1. To explain the basic concept of python , object oriented programming and illustrate coding in Python Programming Language.
2. To make students capable of Implementing programs and applications using various features of python programming

Course Outcomes:

After completing the course, students will be able to

On successful completion of this subject the student will be able to:

1. Understand and implement the basic concept of python programming language.
2. Develop Code and test conditional statement of moderate size using the python language.
3. Implement the concept of Function and modules in programming language
4. Understand and Implement the concept of object oriented programming in python programming language.
5. Know and demonstrate the working of files for good program design using python language.

UNIT I : **(08 Hours)**

Introduction to Python, Domains, Python Basics: Identifiers and Keywords, Comments, Indentation and Multi-lining Python Types, Operations and Conversions, Python Format, Python Operators. Variables and Data Types, String Manipulation: Accessing Strings, Basic Operations, String slices, Lists: Introduction, Accessing list, Operations, Working with lists, Tuple: Introduction, Accessing tuples, Operations, Sets and Dictionaries.

UNIT II : **(07 Hours)**

Operator Conditional Statements : If, If- else, Nested if-else, Using NOT, AND, IN,Operator with If Else .Looping : For Loop Syntax, For Loop Workflow, Examples of For, Loop, Range() Function with for loop, Else Clause with For Loop, While Syntax, Examples, Nested loops, Control Statements, Break, Continue, Pass.

UNIT III : **(07 Hours)**

Functions : Built-in, Functions, Library Functions, Defining a function,Calling a function, Types of functions, Function, Arguments, Mutable Arguments and Binding of Default Values, Global and local Variables.

UNIT IV : **(08 Hours)**

Introduction to Object Oriented Programming (OOP), Features of OOP, Python Class and Objects, Classes and methods, Constructor and Destructor, Simple and Multiple Inheritance.

UNIT V : **(06 Hours)**

Working with Files: File Input Output, Read and Write Operations, Set File offset in Python, Python File object methods.

Text Books:

1. Let Us Python- 2nd Revised & Updated Edition By Yashavant Kanetkar, Aditya Kanetkar , ISBN: 9789389845006, Edition: 2020/ 2nd.
2. Core Python Programming Kindle Edition by Dr. R. Nageswara Rao.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B.TECH.) DEGREE COURSE
SEMESTER: (C.B.C.S.)
BRANCH: INFORMATION TECHNOLOGY

Open Elective-II Java Programming : **Subject Code : BTIT704T.2**

Load	Credit	Internal Marks	University Marks	Total
03 Hrs	03	30	70	100

Prerequisite(s): C Language

Course Objective/Learning Objective:

1	To introduce the concepts of Java programming language and its application in software development.
2	To develop a sound understanding of Java programming constructs such as variables, operators, control statements, loops, and arrays.
3	To provide students with a strong foundation in object-oriented programming concepts such as inheritance, polymorphism, encapsulation, and abstraction.
4	To enable students to create and use classes, objects, and methods in Java programs.
5	To teach students how to handle exceptions and use various input/output techniques in Java programs.

Course Outcome:

At the end of this course Student are able to:

CO1	Understand the fundamentals of Java programming language and its application in software development.
CO2	Implement Java programming constructs such as variables, operators, control statements, loops, and arrays.
CO3	Design and implement object-oriented programs using inheritance, polymorphism, encapsulation, and abstraction concepts in Java.
CO4	Create and use classes, objects, and methods in Java programs.
CO5	Handle exceptions and use input/output techniques in Java programs.

UNIT I: **(08Hrs)**

Introduction to Java Programming: Introduction to Java programming language Java Virtual Machine (JVM), Java Development Kit (JDK), Overview of Java programming environment, Simple Java program and its execution

UNIT II: **(07 Hrs)**

Java Programming Constructs: Variables and data types, Operators, and expressions Control statements: if-else, switch, for, while, do-while, Arrays: single-dimensional and multi-dimensional arrays, Strings and string manipulation.

UNIT III: **(07 Hrs)**

Object-Oriented Programming Concepts in Java: Classes and objects, Methods and constructors, inheritance: single and multilevel inheritance, Polymorphism: method overloading and overriding, Encapsulation and abstraction.

UNIT IV: **(07 Hrs)**

Handling Exceptions in Java: Exception handling: try-catch, throw, throws, Exception hierarchy in Java, Checked and unchecked exceptions, Creating custom exceptions.

UNIT V: **(07 Hrs)**

Input/Output Techniques in Java: File handling in Java, Reading and writing data using streams, Serialization and deserialization, Networking programming in Java: sockets and URLs.

Textbooks:

- Java: The Complete Reference by Herbert Schildt, McGraw Hill Education, 11th edition, 2018.Severance, C. (2016).
- "Head First Java" by Kathy Sierra and Bert Bates.

References:

- Core Java Volume I – Fundamentals by Cay S. Horstmann and Gary Cornell, Prentice Hall, 11th edition, 2018.
- Java How To Program by Paul Deitel and Harvey Deitel, Pearson Education, 11th edition, 2017.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.TECH.) DEGREE COURSE
SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: INFORMATION TECHNOLOGY

Open Elective-II : Data Base Management System **Subject Code : BTIT704T.3**

Load	Credit	Internal Marks	University Marks	Total
03 Hrs	03	30	70	100

Aim: To understand basic concepts of Database Management System.

Prerequisite(s): NIL

Course Objective/Learning Objective:

1.	To introduce a general idea of a database management system.
2.	To develop skills to implement real life applications that involve database handling.
3.	To provide opportunities in subject areas of data handling and managing techniques

Course Outcome:

At the end of this course Student are able to:

CO1.	Understand the basics of DBMS to analyze an information problem in the form of an Entity relation diagram and design an appropriate data model for it.
CO2.	Demonstrate basics of File organizations and its types
CO3.	Interpret functional dependencies and various normalization forms
CO4.	Perform basic transaction processing and management
CO5	Demonstrate SQL queries to perform CRUD (Create, Retrieve, Update, Delete) operations on database.

UNIT I: (08 Hrs)

Introduction to DBMS - Purpose of Database Systems, Database systems Applications, view of data, Database Languages, Database system structure, data methods, Database Design,& ER Model : Entity, Attributes, Relationships, Constraints, Keys, Design Process, ER Models, E-R Diagram.

UNIT II: (07 Hrs)

File organizations and its types, indexing, types of indexing, hashing, hashing techniques.

UNIT III: (07 Hrs)

Functional Dependency (FD) – data integrity rules, functional dependency, need of normalization, first normal form, second normal form, third normal form

UNIT IV: (07 Hrs)

Database Transaction Processing : transaction system concepts, desirable properties(ACID) of transactions, schedules, serializability of schedules, concurrency control, recoverability and Deadlock handling.

UNIT V: (07 Hrs)

SQL Concepts - Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints, Functions - aggregate functions, Built-in functions –numeric, date, string functions, set operations, Use of group by, having, order by, join and its types, Exist, Any, All.

Textbooks:

- Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts 4th Ed, McGraw Hill, 2010.
- Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems (5/e), Pearson Education, 2008.
- Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems (3/e), McGraw Hill

References:. .

- Peter Rob and Carlos Coronel, Database Systems- Design, Implementation and Management (7/e),Cengage Learning, 2007.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.TECH.) DEGREE COURSE
SEMESTER: EIGTH (C.B.C.S.)
BRANCH: INFORMATION TECHNOLOGY

Subject : Elective-IV Social Networks **Subject Code : BTIT801T.1**

Load	Credit	Internal Marks	University Marks	Total Marks
03 Hrs	03	30	70	100

Aim : To understand social networks and use of tools for social network analysis.
Prerequisite(s): Discrete Mathematics

Course Objective/Learning Objective:

1	To understand highly interconnected and hence more complex social networks
2	To represent connected social networks in form of graph
3	To apply graph theory, sociology, game theory
4	To use tools and extract statistics from social networks

Course Outcome:
At the end of this course Student are able to:

CO1	Learn social networks , its types and representation
CO2	Understand weak ties, strong and weak relationships , homophily and calculate
CO3	Analyse links
CO4	Understand Power Laws and Rich-Get-Richer Phenomena
CO5	Understand Small World Phenomenon

Week 1: Introduction
Week 2: Handling Real-world Network Datasets
Week 3: Strength of Weak Ties
Week 4: Strong and Weak Relationships (Continued) & Homophily
Week 5: Homophily Continued and +Ve / -Ve Relationships
Week 6: Link Analysis
Week 7: Cascading Behaviour in Networks
Week 8: Link Analysis (Continued)
Week 9: Power Laws and Rich-Get-Richer Phenomena
Week 10: Power law (contd..) and Epidemics
Week 11: Small World Phenomenon
Week 12: Pseudocore (How to go viral on web)

References:

- https://onlinecourses.nptel.ac.in/noc23_cs19/preview
- Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010
- (available for free download).
- Social and Economic Networks by Matthew O. Jackson, Princeton University Press, 2010.

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SEMESTER: EIGHT(C.B.C.S.)
BRANCH: INFORMATION TECHNOLOGY

Subject : Elective-VI Reinforcement Learning **Subject Code : BTIT801T.2**

Load	Credit	Internal Marks	University Marks	Total Marks
03 Hrs	03	30	70	100

Prerequisite(s): Learnings & Neural Netowrks

Course Objective/Learning Objective:

1	It aims to model the trial-and-error learning process that is needed in many problem situations where explicit instructive signals are not available.
2	It has roots in operations research, behavioral psychology and AI.
3	The goal of the course is to introduce the basic mathematical foundations of reinforcement learning.
4	It highlight some of the recent directions of research

Course Outcome:

At the end of this course Student are able to:

CO1	Understand Bandit algorithm and its mathematical formulation.
CO2	Use dynamic programming for reinforcement learning
CO3	Perform function approximation and apply LSM
CO4	Fit Q, DQN & Policy Gradient for Full RL
CO5	Use combinatorial models for complex problems

Week 1	Introduction
Week 2	Bandit algorithms – UCB, PAC
Week 3	Bandit algorithms –Median Elimination, Policy Gradient
Week 4	Full RL & MDPs
Week 5	Bellman Optimality
Week 6	Dynamic Programming & TD Methods
Week 7	Eligibility Traces
Week 8	Function Approximation
Week 9	Least Squares Methods
Week 10	Fitted Q, DQN & Policy Gradient for Full RL
Week 11	Hierarchical RL
Week 12	POMDPs

References

- https://archive.nptel.ac.in/courses/106/106/106106143/
- R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 1998.

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SEMESTER: EIGTH (C.B.C.S.)

BRANCH: INFORMATION TECHNOLOGY

Subject : **GPU Architectures and Programming** **Subject Code :** **BTIT801T.3**

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03 Hrs (Theory)	03	100	30	70	100

Aim : To understand GPU architecture basics in terms of functional units and then dive into the popular CUDA programming model commonly used for GPU programming.
Prerequisite(s): Programming and Data Structure, Digital Logic, Computer architecture

Course Objective/Learning Objective:

1	To introduce basics of conventional CPU architectures, their extensions for single instruction multiple data processing (SIMD)
2	To understand concept in the form of single instruction multiple thread processing (SIMT) as is done in modern GPUs.
3	To teach architecture specific details
4	To introduce different architecture-aware optimization techniques relevant to both CUDA and OpenCL

Course Outcome:

At the end of this course Student are able to:

CO1	Understand conventional CPU architectures, their extensions for single instruction multiple data processing (SIMD)
CO2	Program in CUDA about data space & synchronization
CO3	Apply optimization on kernals, thtreads etc
CO4	Learn basics of OpenCL
CO5	Design an application using neural networks

Week 1: Review of Traditional Computer Architecture – Basic five stage RISC Pipeline, Cache Memory, Register File, SIMD instructions
Week 2: GPU architectures - Streaming Multi Processors, Cache Hierarchy, The Graphics Pipeline
Week 3: Introduction to CUDA programming
Week 4: Multi-dimensional mapping of dataspace, Synchronization
Week 5: Warp Scheduling, Divergence
Week 6: Memory Access Coalescing
Week 7: Optimization examples : optimizing Reduction Kernels

Week 8: Optimization examples : Kernel Fusion, Thread and Block Coarsening
Week 9: OpenCL basics
Week 10: CPU GPU Program Partitioning
Week 11: Application Design : Efficient Neural Network Training/Inferencing
Week 12: Application Design : Efficient Neural Network Training/Inferencing,cont'd

References:

- https://onlinecourses.nptel.ac.in/noc23_cs61/preview
- "Computer Architecture -- A Quantitative Approach" - John L.Hennessy and David A. Patterson "Programming Massively Parallel Processors" - David Kirk and Wen-mei Hwu
- Heterogeneous Computing with OpenCL" -- Benedict Gaster,Lee Howes, David R. Kaeli

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SEMESTER: EIGTH (C.B.C.S.)

BRANCH: INFORMATION TECHNOLOGY

Program Elective-VII

Subject : **Predictive Analytics - Regression and Classification** **Subject Code :** **BTIT802 T.1**

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03 Hrs (Theory)	03	100	30	70	100

Aim : To The course will provide an overview of fundamental ideas in statistical **predictive** models.
Prerequisite(s): Probability and Statistics

Course Objective/Learning Objective:

1	The course will provide an overview of fundamental ideas in statistical predictive models
2	. The objective is to understand how statistical models handle prediction problems.
3	The stress will be on understanding the construction of the models and implementation.
4	It is a core course if students aspire to be Data Scientists.

Course Outcome:

At the end of this course Student are able to:

CO1	To understand predictive models, LSM, Normal equations and GMT
CO2	Understand regression models and infer its statistical inference
CO3	Check model assumptions and bias variance tradeoff.
CO4	Perform regression analysis in various programming languages
CO5	Apply regression models and classification for predictive analysis

Week 1:
- Landscape of the predictive models.
- Least Squares method

Week 2:
- Normal Equations:
- Gauss Markov theorem

Week 3:
- The geometry of Regression Model and Feature Engineering
- Statistical Inference of Regression Coefficient

Week 4:
- Checking Model Assumptions
- Model Comparison with R-squared, RMSE, AIC or BIC

Week 5:
- Model Complexity and Bias-Variance tradeoff
- Feature selection and Dimension Reduction

Week 6:
- Multicollinearity and Variance Inflation Factor
- Regularization with LASSO, Ridge and Elastic Net
- Ridge Regression with Python

Week 7:
- Regression Analysis with Python
- Regression Analysis with R
- Regression Analysis with Julia

Week 8: Major Applications of Regression Models
- Capital Asset Pricing Model
- Bootstrap Regression
- Time Series Forecasting with Regression Model
- Granger Causal model.

Week 9:
- Logistic Regression
- MLE of coefficient of Logistic Regression

Week 10:
- Fit Logistic Regression with optim function in R
- Fit Logistic Regression with glm function in R
- Fit Logistic Regression with sklearn in Python
- Fit Logistic Regression in Julia

Week 11:
- Logistic Regression and Inference
- Discriminant Analysis

Week 12:
- Multinomial Logit Regression
- Generalised Linear Regression
- Poisson Regression
- Negative Binomial Regression

References:

1) https://onlinecourses.nptel.ac.in/noc23_ma46/preview
2)An Introduction to Statistical Learning by James, Witten, Hastie, and Tibshirani, Springer (https://www.statlearning.com/)
3) The Elements of Statistical Learning by Hastie, Tibshirani, and Friedman, Springer (https://hastie.su.domains/Papers/ESLII.pd)
4) Regression and Other Stories by Gelman, Hill, and Vehtari, by Cambridge University Press (https://avehtari.github.io/ROS-Examples/)

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SEMESTER: EIGTH (C.B.C.S.)

BRANCH: INFORMATION TECHNOLOGY

Subject : Data Analytics with Python Subject Code : BTIT802T.2

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03 Hrs (Theory)	03	100	30	70	100

Aim : To give hands-on experience using python for creating analytics models

Prerequisite(s): Nil

Course Objective/Learning Objective:

1	To learn analytics using python programming language
2	Learn hypothesis testing and ANOVA model
3	Regression models and its implementation
4	Learn clustering and classification

Course Outcome:

At the end of this course Student are able to:

CO1	Understand data analytics and Python fundamentals
CO2	Perform sampling using various methods and perform hypothesis test or ANOVA test
CO3	Fit linear regression model and calculate various errors
CO4	Apply ROC
CO5	Apply clustering and classification using python programming

Week 1	:	Introduction to data analytics and Python fundamentals
Week 2	:	Introduction to probability
Week 3	:	Sampling and sampling distributions
Week 4	:	Hypothesis testing
Week 5	:	Two sample testing and introduction to ANOVA
Week 6	:	Two way ANOVA and linear regression
Week 7	:	Linear regression and multiple regression
Week 8	:	Concepts of MLE and Logistic regression
Week 9	:	ROC and Regression Analysis Model Building
Week 10	:	c^2 Test and introduction to cluster analysis
Week 11	:	Clustering analysis
Week 12	:	Classification and Regression Trees (CART)

References:

- https://archive.nptel.ac.in/courses/106/107/106107220/
- McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
- Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.
- Ken Black, sixth Editing. Business Statistics for Contemporary Decision Making. "John Wiley & Sons, Inc".
- Anderson Sweeney Williams (2011). Statistics for Business and Economics. "Cengage Learning".
- Douglas C. Montgomery, George C. Runger (2002). Applied Statistics & Probability for Engineering. "John Wiley & Sons, Inc"
- Jay L. Devore (2011). Probability and Statistics for Engineering and the Sciences. "Cengage Learning".
- David W. Hosmer, Stanley Lemeshow (2000). Applied logistic regression (Wiley Series in probability and statistics). "Wiley-Interscience Publication".
- Jiawei Han and Micheline Kamber (2006). Data Mining: Concepts and Techniques. "
- Leonard Kaufman, Peter J. Rousseeuw (1990). Finding Groups in Data: An Introduction to Cluster Analysis. "John Wiley & Sons, Inc".

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SEMESTER: EIGTH (C.B.C.S.)

BRANCH: INFORMATION TECHNOLOGY

Subject : Computer Vision **Subject Code : BTIT802T.3**

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03 Hrs (Theory)	03	100	30	70	100

Aim : The course will have a comprehensive coverage of theory and computation related to imaging geometry, and scene understanding. It will also provide exposure to clustering, classification and deep learning techniques applied in this area.

Prerequisite(s): Liner Algebra, Vector Calculus, Data Structures and Programming

Course Objective/Learning Objective:

1	To cover theory and computation related to imaging geometry, and scene understanding.
2	To learn feature extraction and matching
3	To process various parameters in images
4	To expose to clustering, classification and deep learning techniques applied in this area.

Course Outcome:

At the end of this course Student are able to:

CO1	Understand 2-D Projective Geometry, homography
CO2	Understand camera and stereo geometry
CO3	Detect and match features
CO4	Process color and range in images
CO5	Apply clustering, classification and deep learning models

Week 1: Fundamentals of Image processing
Week 2: 2-D Projective Geometry, homography, and Properties of homography
Week 3: Camera geometry
Week 4: Stereo geometry
Week 5: Stereo geometry
Week 6: Feature detection and description
Week 7: Feature matching and model fitting
Week 8: Color processing
Week 9: Range image processing
Week 10: Clustering and classification
Week 11: Dimensionality reduction and sparse representation
Week 12: Deep neural architecture and applications

Books and references

- https://archive.nptel.ac.in/courses/106/105/106105216/
- Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press.
- Computer Vision: Algorithms & Applications, R. Szeleski, Springer.
- Computer vision: A modern approach: Forsyth and Ponce, Pearson.