MGM UNIVERSITY

University Department of Information and Communication Technology

(With effect from Academic Year 2021-22)

Vision Statement of the University

- To ensure sustainable human development which encourages self-reliant and self-content society.
- To promote activities related to community services, social welfare and also Indian heritage and culture.
- To inculcate the culture of non-violence and truthfulness through vipassanna meditation and Gandhian Philosophy.
- To establish a centre of excellence for modern education, research, innovation and all round development of students
- To develop the culture of simple living and high thinking.

Mission Statements of the University

- Inculcate scientific temperament enquiring abilities and inquisitive attitude Emphasis on interdisciplinary education and programme
- Creating unwavering sensitivity to ethics, morality and healthy practices in professional and personal life
- Providing education in disciplined related to Indian art and rich heritage thereby preserving our ancient knowledge and wisdom
- Infuse a culture of interdisciplinary education for broader understanding and enrichment of life
- Creating an environment where empathy, service to society and societal concern become a second nature
- Empower students to fit into the word of 'new economic order' and help India to attain 'pride of place' at global level.

Vision Statement of Department

The UDICT shall establish a center-of-excellence with social and global approaches for the development of trained human resources with professional approaches to innovation, entrepreneurship, and knowledge of emergent technologies for industry and research in diverse domains.

Mission Statements of Department

The UDICT shall

1. Empower students with human values, environment-friendly qualities and ethical approaches.
2. Create technocrats for a sustainable growth in the industrial sector with an interdisciplinary aptitude.
3. Hone their skills for becoming experts with state-of-art knowledge in social perspectives and research directions

Program Outcomes (POs)

PO No.	Program Outcome Description
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design / Development of solution:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigation of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer & society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment & sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual & team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management & finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Credit System

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
2 Hours Practical (Lab)/week	1 credit

Example: Course XXXXXX with (3-0-2) as (L-T-P) structure, i.e. 3 hr. Lectures + 0 hr. Tutorial + 2 hr. Practical per week, will have (3x1 + 0x1 + 2x0.5 =) 4 credits.

Total credits - Total credits of 40 for a student to be eligible to get Undergraduate Degree.

Course codes – Course codes are assigned as follows

BT- Bachelor of Technology

IT- Information Technology

1: Year

1, 2: Semesters

01, 02… Course sequence

L – Lab

P- Project

For Example, a course code of BTIT1101 implies a course of Bachelor of Technology program in Information Technology of first year, first semester and first in sequence.

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Fifth semester									
Code	**Name of the course**	**Theory**	**Practical (hours)**	**Tutorial**	**Credits**	**CA**	**MSE**	**ESE**	**Total**
BTIT3101	**Design and Analysis of Algorithms**	**3**			**3**	**20**	**20**	**60**	**100**
BTIT3102	**Information Retrieval**	**3**			**3**	**20**	**20**	**60**	**100**
BTIT3103	**Digital Image Processing**	**3**			**3**	**20**	**20**	**60**	**100**
BTIT3104	**Geographical Information Systems**	**3**			**3**	**20**	**20**	**60**	**100**
Elective: BTIT3105 BTIT3106 BTIT3107	**Elective - I: A. Basics of Blockchain B. Microprocessors, Microcontrollers and IoT Devices C. Introduction to Big Data & Hadoop**	**3**			**3**	**20**	**20**	**60**	**100**
BTIT3101L	**Design and Analysis of Algorithms - Laboratory**		**2**		**1**	**30**		**20**	**50**
BTIT3102L	**Information Retrieval - Laboratory**		**2**		**1**	**30**		**20**	**50**
BTIT3103L	**Digital Image Processing - Laboratory**		**2**		**1**	**30**		**20**	**50**
BTIT3105L BTIT3106L BTIT3107L	**Elective - I (Laboratory) A. Basics of Blockchain B. Microprocessors, Microcontrollers and IoT Devices C. Introduction to Big Data & Hadoop**		**2**		**1**	**30**		**20**	**50**
BTIT3108P	**Soft skills**		**2**		**1**	**30**		**20**	**50**
	TOTAL	**15**	**8**	**0**	**20**	**250**	**100**	**400**	**750**

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Sixth semester									
Code	**Name of the course**	**Theory**	**Practical (hours)**	**Tutorial**	**Credits**	**CA**	**MSE**	**ESE**	**Total**
BTIT3201	**Web Enabled Software Engineering**	**3**			**3**	**20**	**20**	**60**	**100**
BTIT3202	**Computer Vision and Pattern recognition**	**3**			**3**	**20**	**20**	**60**	**100**
BTIT3203	**Information Theory and Coding**	**3**			**3**	**20**	**20**	**60**	**100**
BTIT3204 BTIT3205 BTIT3206	**Elective - II: A. Smart Contract B. IoT Communications C. Big Data Modeling and Management**	**3**			**3**	**20**	**20**	**60**	**100**
BTIT3207 BTIT3208 BTIT3209	**Elective - III: A. Decrentralised Applications B. IoT Networking C. Big Data Information and Processing**	**3**			**3**	**20**	**20**	**60**	**100**
BTIT3201L	**Web Enabled Software Engineering - Practical**		**2**		**1**	**30**		**20**	**50**
BTIT3202L	**Computer Vision and Pattern recognition - Practical**		**2**		**1**	**30**		**20**	**50**
BTIT3203L	**Information Theory and Coding - Practical**		**2**		**1**	**30**		**20**	**50**
BTIT3204L BTIT3205L BTIT3206L	**Elective - II - Practical: A. Smart Contract B. IoT Communications C. Big Data Modeling and Management**		**2**		**1**	**30**		**20**	**50**
BTIT3207L BTIT3208L BTIT3209L	**Elective - III - Practical: A. Decrentralised Applications B. IoT Networking C. Big Data Information and Processing**		**2**		**1**	**30**		**20**	**50**

		15	**10**	**0**	**20**	**250**	**100**	**400**	**750**

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Semester – V

Course Code:	BTIT3101	**Title:** Design and Analysis of Algorithms	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	**-**	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	1. To learn fundamentals of algorithm design techniques. 2. To understand basic knowledge of computational complexity, approximation and randomized algorithms, selection of the best algorithm to solve a problem. 3. To design and analyse the performance of algorithms and to compare algorithms with respect to time and space complexity. 4. To develop proficiency in problem solving and programming.
Course Outcomes	After learning the course, the students should be able to: 1. Gain understanding of concepts of time and space complexity in terms of worst, average and best case using Asymptotic Notations. 2. Design standard algorithms such as sorting, searching, problems involving graphs etc. using various design techniques and compute complexity measures of these algorithms. 3. Design algorithms for optimization problems
Pre-requisites	1. Programming in C/C++ Language 2. Discrete Mathematical Structure 3. Data Structures
Unit I: Introduction	Fundamental concepts of algorithm: characteristics, Specifications; Frequency count and its importance in analysis of an algorithm; Asymptotic Notations, Time complexity & Space complexity of an algorithm; Sorting methods: bubble, insertion, heap sort. Analysis of each sorting technique for best, worst and average cases. Concepts of Internal & External sorting.
Unit II: Divide and Conquer	The general method, Binary Search, finding the maximum and minimum, Merge Sort, Quick Sort, selection and Strassen's matrix multiplication.
Unit-III: Greedy Method	The general method, optimal storage on tapes, Knapsack problem, Job sequencing with deadlines, Optimal merge patterns, Minimum spanning trees, Single source shortest paths.
Unit- IV: Dynamic Programming and Traversal	The general method, Multistage graphs, All pairs shortest paths, 0/1 Knapsack, The Travelling salesman problem. Tree traversal techniques, Graph traversal techniques: DFS, BFS, connected

Techniques	components, Bi-connected components & spanning trees.
Unit- V: Backtracking	The general Method, The 8-Queens Problems, Sum of subsets, Graph coloring. Hamiltonian cycles.
Unit- VI: Branch-and-bound	The method, Least cost (LC) search, The 15-puzzle, Control abstractions for LC search, FIFO branch and bound, LC branch and bound.

T*ext* Books:

1. E. Horowitz, S. Sahni and S. Rajsekaran, "Computer Algorithms", Silicon Press, 2nd Edition, 2008.

2. Thomas Cormen, Charles Leiserson, Ronald Rivest and Cliford Stein, "Introduction to Algorithms", MIT Press, 3rd Edition, 2009.

Reference Books:

1. B. K. Joshi, "Data Structures and Algorithms in C++", Tata McGraw Hill Education, 2010.

2. G. T. Heineman, Gary Pollice, Stanley Selkow, "Algorithms in a Nutshell", Shroff Publication, 1st Edition, 2008.

E-sources:

https://nptel.ac.in/courses/106101060/

Course Code:	BTIT3102	**Title:** Information Retrieval	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	**-**	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	Students will be able to Understand 1. Need of Information Retrieval 2. Use of IR in Information Search 3. Information Retrieval Modeling and Evaluation 4. Preprocessing in IR Systems 5. Text based and Web Based Retrieval Systems
Course Outcomes	
Pre-requisites	1. Web Technology 2. Database system
	SECTION-A
Unit 1: Introduction to Information Retrieval	Information Retrieval in Libraries and Digital Libraries, The IR Problem, The IR System, How The Web Changed Search. User Interfaces for Search, Search Interfaces Today, Visualization in Search Interfaces.
Unit 2: Information Retrieval Modeling	IR Models: Modeling and Ranking, Characterization of an IR Model, A Taxonomy of IR Models, Classic Information Retrieval: Basic Concepts, The Boolean Model, Term Weighting, TF-IDF Weights, Document Length Normalization, The Vector Model, Set-Based Model, Extended Boolean Model, Generalized Vector Space Model.
Unit 3: Information Retrieval	Retrieval Metrics: Precision and Recall, MAP, MRR, F, User Oriented Measures, DCG: Discounted Cumulated Gain, BPREF: Binary Preferences, Rank Correlation Metrics.

Evaluation	
	SECTION-B
Unit 4: Documents: Languages & Properties	Metadata, Text Document Format, Markup Languages, RDF: Resource Description Framework, Text Properties, Information Theory, Text Similarity, Document Preprocessing , Lexical Analysis of the Text , Elimination of Stop words, Stemming , Keyword Selection, Queries: Languages & Properties, Query Languages: Keyword-Based Querying, Structural Queries, Query Protocols, Query Properties
Unit 5: Text Classification and Indexing	A Characterization of Text Classification, Unsupervised Algorithms, Supervised Algorithms, Feature Selection or Dimensionality Reduction, Evaluation Metrics, Inverted Indexes.
Unit 6: Web Retrieval	The Web, Characteristics, Structure of the Web, Modeling the Web, Link Analysis, Search Engine Architectures, Search Engine Ranking, Managing Web Data, Search Engine User Interaction, Browsing, Beyond Browsing.

T*ext* Books:

1. Modern Information Retrieval the Concepts and Technology behind Search by Ricardo

Baeza-Yates Berthier Ribeiro-Neto Second edition Addison-Wesley 2011

Reference Books:

1. Introduction to Information Retrieval by C.D. Manning, P. Raghavan, H. Schütze. Cambridge

UP, 2008.

2. Search Engines: Information Retrieval in Practice by Bruce Croft, Donald Metzler, Trevor

Strohman Pearson 2010.

Course Code:	BTIT3103	**Title:** Digital Image Processing	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	**-**	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	Students should 1. understand fundamental digital image processing steps and mathematical models in digital image 2. apply enhancement restoration segmentation image processing algorithm. **3.** develop time and frequency domain techniques for image enhancement.
Course Outcomes	At the end of this course, students will be able to: 1. Understand theory and mathematical models in Image Processing. 2. Describe and apply Enhancement, segmentation, morphology methods. **3.** Describe image representation , description and understand object recognition methods.
Pre-requisites	1. Elements of visual perception. **2.** Basic linear algebra and Fourier transform Set theory
Unit I: Introduction	Fundamentals: Image acquisition, sampling and quantization, image resolution, basic relationship between pixels, color images, RGB, HSI and other models Image Transforms **:** DFT, DCT, Walsh Hadamard Transform.
Unit II: Image enhancement	Point processing , histogram equalization and specification Noise Model Smoothing Spatial Filters: Linear filters (Order Statistic) spatial filters: Sharpening spatial Filters**:** Foundation, Using First Order Derivatives for image harpening – The Gradient, Using Second Order Derivatives for image sharpening – The Laplacian, Frequency domain methods**:** Basic steps for filtering in Frequency Domain, Frequency Domain low pass and high pass Filters.
Unit-III:	Coding Redundancy, Spatial and Temporal Redundancy, Psychovisual

Image Compression	Redundancy Measuring Image Information: Entropy, Fidelity Criteria, Losssless Compression Methods: Huffman coding, LZW coding, Run length coding, Lossy Compression Techniques: Block transform Coding.
Unit- IV: Image Segmentation	Fundamentals**:** Point, Line, Edge Detection, Detection of Isolated Points, Line Detection Edge Models, Basic Edge detection, Canny edge detector Thresholding, Region-based Segmentation Methods Region Growing, Region Splitting and Merging.
Unit- V: Morphological Image Processing	Preliminaries, Erosion and dilation, opening and closing ,The Hit-or-Miss Transformation Some Basic Morphological Algorithms: Boundary extraction, Region filling, thinning.
Unit- VI: Image Representation and Description	Boundary Descriptors Regional Descriptors Patterns and pattern Classes Recognition based on Decision Theoretic Methods

T*ext* Books:

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education.
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar “Digital Image Processing”, McGraw Hill Publication.
3. Rafael C. Gonzalez, Richard E. Woods, Eddins, “Digital Image Processing using MATLAB”, Pearson Education.
4. Anil K. Jain, “Fundamentals of Digital Image Processing”, PHI

Reference Books:

1. B. ChaB. Chanda, Dutta Majumdar, “Digital Image Processing and Analysis”, PHI
2. Ze-Nian Li and Mark S. Drew, "Fundamentals of Multimedia", PHI 2011.
3. Murat Tekalp, "Digital Video Processing", Pearson, 2010.
4. John W. Woods, "Multidimensional Signal, Image and Video Processing", Academic Press 2012.
5. A.I.Bovik, "Handbook on Image and Video Processing", Academic Press

E-sources:

1. https://www.tutorialspoint.com/dip
2. https://nptel.ac.in/courses/117105079
3. http://www.imageprocessingplace.com/root_files_V3/tutorials.htm
4. https://www.geeksforgeeks.org/digital-image-processing-basics/
5. https://www.digimat.in/nptel/courses/video/11710513.

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Semester – V

Course Code:	BTIT3104	**Title:** Geographical Information Systems	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	**-**	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	1. Demonstrate understanding and competency of GIS theory 2. Demonstrate understanding spatial data collection, format, storage, and editing; 3. Analyze spatial data 4. Design maps for Smart City 5. Demonstrate the ability to use QGIS software.
Course Outcomes	
Pre-requisites	1. Knowledge of Geography 2. Basic Mathematical Formulas 3. Concepts of Image Processing
	SECTION-A
Unit 1: GIS – An Overview	Introduction, Defining GIS, Components of GIS, Spatial Data, Maps & their Influence on the Character of Spatial Data, Thematic Characters, Other Sources of Spatial Data.
Unit 2: Spatial Data Modeling and Database Management [6 hrs]	Spatial Data Modeling, Entity Definition, Spatial Data Models, Spatial Data Structures, Modeling Surfaces Modeling, Networks, Building, Computer Worlds, Modeling the Third and Fourth Dimension.
Unit 3: Database Management and Data Editing [8 hrs]	Database Approach, Attribute Data in GIS, Relational Model, Attribute Data Entry, Manipulation of Fields and Attribute Data, GIS Database Applications, Web GIS, Developments in Databases, Data Input and Editing, Methods of Data Input, Data Editing, Integrated Database.

	SECTION-B
Unit 4: Data Analysis [6 hrs]	Measurements in GIS-Lengths, Perimeters, Areas, Queries, Reclassification, Buffering and Neighborhood Functions, Map Overlay, Spatial Interpolation, Analysis of Surfaces, Network Analysis.
Unit 5: Modeling and Output [6 hrs]	Analytical Modeling in GIS, Modeling Physical and Environmental Processes, Modeling Human processes, Modeling the Decision-Making Process, Output: from New Maps to Enhanced Decisions, Maps as Output, Non-Cartographic Output, Spatial Multimedia, Mechanisms of Delivery, GIS and Spatial Decision Support.
Unit 6: Remote Sensing and Applications [8 hrs]	Definition of Remote Sensing, Physical Principles of Remote Sensing- Electromagnetic Radiation and Spectrum, Imaging Systems/Sensors- Active and Passive, Characteristics of Sensors - Spectral, Radiometric, Spatial and Temporal Resolution, LandSat Program, Applications of Remote Sensing - Agriculture, Land Cover and Use, Forest, and Atmosphere Monitoring.

T*ext* Books:

1. Ian HeyWood, Sarah Cornelius Steve Carver, “An Introduction to Geographical Information Systems”, Pearson Education, Second Edition

2. Kang-tsung Chang, “Introduction to Geographic Information Systems”, Tata McGrawHill, Fourth Edition.

Reference Books:

1. Peter A. Burrough, Rachael A. McDonnell, “Principles of Geographical Information System”, Oxford University Press.

2. Keith C. Clarke, Bradley O. Parks, Michael P. Crane, “Geographical Information Systems and Environmental Modeling”, Prentice-Hall India.

3. Fundamentals of Remote Sensing 2nd Edition George Joseph Universities Press.

4. Remote Sensing and Image Interpolation by Lillesand, Kiefer Chipman Wiley Publication.

E-sources:

• https://www.tankonyvtar.hu/en/tartalom/tamop425/0027_DAI6/index.html (Remote Sensing)

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Semester – V

Course Code:	**BTIT3105**	**Title: Elective-I:A. Basics of blockchain**	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	-	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	1. Explain what blockchain is and how it works 2. Describe how bitcoin operates and how it relates to blockchain 3. Explore Consensus algorithms 4. Learn about Hyperledger and Ethereum 5. Evaluate and describe other applications of blockchain 6. Articulate and describe the limitations of blockchain
Course Outcomes	After learning the course, the student will be able: 1. Explore the major components of Blockchain 2. Describe Cryptocurrency, Bitcoin and its operations 3. Learn about Bitcoin consensus algorithms 4. Learn about distributed consensus 5. Understand architecture of Hyperledger and Ethereum Platforms 6. Evaluate potential Blockchain uses cases from a business, legal, and

	engineering perspective.
Pre-requisites	**1. Data Structure and Files,** **2. Expertise in Programming,** **3. Database management system, Computer Security, Cryptography, Networking**
	SECTION-A
UNIT I-INTRODUCTION TO BLOCKCHAIN	Brief history of Blockchain, Decentralization, ledgers, distributed ledgers, consensus, Blockchain- Public Ledgers, Blockchain as Public Ledgers - Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree.
UNIT II – BITCOIN AND CRYPTOCURRENCY	A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network.
UNIT III-BITCOIN CONSENSUS	Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment Paxos.
	SECTION-B
UNIT IV-DISTRIBUTED ONSENSUS	RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance.
UNIT V-HYPER LEDGER FABRIC & ETHERUM	Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, TruffleDesign and issue Crypto currency, Mining, Distributed applications (dApps), Decentralized autonomous organizations (DAO).
UNIT VI-BLOCKCHAIN USE CASES	When to Use a Blockchain (Limitations and Misconceptions),Challenges for Blockchain, Internet of Things-Medical Record Management System-Blockchain in Government and Blockchain Security-Blockchain Use Cases –Finance, Blockchain in Supply chain traceability.

T*ext* Books:

1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing

Platform, 2017.

3. Kevin Werbach, The Blockchain and the New Architecture of Trust

Reference Books:

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran,2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.
4. 1. Andreas Antonopoulos, The internet of money, 2016 & Mastering Bitcoin
5. Paul Vigna & Michael J. Casey, The age of cryptocurrency, 2015
6. Wattenhofer, The Science of the Blockchain
7. Blockchain: The next Everything by Stephen P. Williams

E-sources:

1. https://nptel.ac.in

2. https://www.coursera.org

3. MIT https://ocw.mit.edu/courses/sloan-school-of-management/15-s12-blockchain-and-money-fall-2018 Youtube: (https://www.youtube.com/watch?v=EH6vE97qIP4)

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Semester – V

Course Code:	**BTIT3106**	**Title: Elective-I: B. Microprocessors, Microcontrollers and IoT Devices**	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	**-**	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	1. To learn the concepts of IoT. 2. Implement different IoT protocols and introduction of sensors 3. Study of IoT design methodology and development 4. Study of data acquisition and supporting services **5.** To learn the concepts of IoT Application.
Course Outcomes	After learning the course, the student will be able: 1. To learn the concepts of IoT. 2. Implement different IoT protocols and introduction of sensors 3. Study of IoT design methodology and development 4. Study of data acquisition and supporting services **5.** To learn the concepts of IoT Application.

Pre-requisites	**1. Understanding of Microprocessor and Microcontroller** **2. Embedded System**
	SECTION-A
Unit 1: IOT	What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues, Trends in the Adoption of IoT, IoT Is Powerful and Pervasive, Societal Benefits of IoT, Risks, Privacy, and Security.
Unit 2: IOT PROTOCOLS	Protocol Standardization for IoT, Efforts –M2M and WSN Protocols – SCADA and RFID Protocols –Issues with IoT Standardization –Unified Data Standards –Protocols –IEEE802.15.4–BAC Net Protocol–Modbus – KNX –Zigbee–Network layer –APS layer –Security.
Unit 3: IOT ARCHITECTURE	IoT Open source architecture (OIC)-OIC Architecture & Design principles-IoT Devices and deployment models-IoTivity : An Open source IoT stack - Overview-IoTivity stack architecture-Resource model and Abstraction.
	SECTION-B
Unit 4: WEB OF THINGS	Web of Things versus Internet of Things –Two Pillars of the Web – Architecture Standardization for WoT–Platform Middleware for WoT – Unified Multitier WoT Architecture –WoT Portals and Business Intelligence.
Unit 5: EMBEDDED SYSTEMS	Embedded Systems, Generic Embedded Systems Structure, Components of Embedded Systems, Sensors and Actuators (in the Lab), Analog/Digital Conversion, Basic Equipment: Hardware and Software, Integrated Circuits, Microcontroller Properties, Microcontroller Components, Compilation and Interpretation.
Unit 6: IOT APPLICATIONS	IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT-A, Hydra etc.

T*ext* Books:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011.
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things –Key applications and Protocols", Wiley, 2012.

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything", 1st Edition, Apress Publications, 2013

3. CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1
4. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013
5. CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1
6. Zach Shelby, Carsten Bormann, "6LoWPAN: The Wireless Embedded Internet", John Wiley and Sons.
7. Dr. OvidiuVermesan, Dr. Peter Friess "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers.

MGM UNIVERSITY, AURANGABAD
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Semester – V

Course Code:	**BTIT3107**	**Title: Elective-I: C. Introduction to Big Data & Hadoop**	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	-	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	1. To know the fundamental concepts of big data. 2. To understand technical and business professionals who need to understand the different types of big data components and the underlying technology concepts that support big data. 3. To understand concepts of Hadoop, Map Reduce, Hadoop file systems (HDFS). 4. To explore tools and practices for working with big data. 5. To know about the research that requires the integration of large amounts of data.

Course Outcomes	
Pre-requisites	1. Students should have the knowledge of programming language (Python, Java). 2. Students should have the knowledge Database Management Systems, and Data warehousing & Data Mining. 3. Student should have hands-on knowledge about Linux Operating Systems.
	SECTION-A
Unit 1: Fundamentals of Big Data	What is Big data? Characteristics of big data and its role in current world, Types of Big Data: Defining Unstructured, Semi-Structure and Structured Data, Technologies being Used to handle and process Big data, Five V's of big data, Big data challenges, Fallbacks of traditional RDBMS in handling and processing Big data, Some Real-world Examples to adopt in major industries.
Unit 2: Introduction to Hadoop (Understanding Hadoop Ecosystem)	What is Hadoop? Hadoop Key Characteristics, Differences between RDBMS & Hadoop, Brief History of Hadoop, Hadoop Ecosystem (Version 1.x & 2.x), Hadoop commands, Components of Hadoop (Version 2.x): HDFS & MapReduce, Architecture of HDFS & Map Reduce, Basic Operations to store and access from HDFS via Command Line, Phases in MapReduce Algorithm, YARN architecture, YARN advantages.
Unit 3: Introduction to Apache Pig	Pig Architecture, Modes of Pig Execution, Operations in Pig: Intro to Pig Latin, Pig Latin Data types, Basic Pig Latin Statements: Loading and Storing Data, Relational and Arithmetic Operators, Debugging Techniques (Dump, Describe, Explain etc.)
	SECTION-B
Unit 4: Introduction to Apache Hive	Hive architecture, Modes of Hive Execution, Operations in Hive: Intro to HiveQL, Basic HiveQL, Hive Tables (Managed Tables & External Tables), Hive Data Types and Data Models, commands: DDL Operations (creating, browsing, updating and deleting tables), DML Operations (Load, Update, Insert and delete data into Hive tables).
Unit 5: HBase & Sqoop Hadoop Projects	Apache HBase: HBase Architecture, HBase Vs RDBMS, HBase Shell Commands. Apache Sqoop: Sqoop Architecture, importing data: Transferring an entire table, specifying a target directory, importing only a subset of data, Incremental Uploads: Importing only new data.

Unit 6: Oozie & Apache Spark	Oozie, Oozie Components, Oozie Workflow, Demo of Oozie Workflow, Scheduling Jobs with Oozie Scheduler, Oozie Coordinator, Oozie Commands, What is Spark? Spark Ecosystem, Spark Components, what is Scala, Why Scala, Spark Context, Spark RDD.

T*ext* Books:

1. Tom White, Hadoop: The Definitive Guide. O'reilly, Fourth Edition, 2011.
2. "Hadoop in Action" Third Edition, Chuck Lam.

Reference Books:

1. "Programming Hive", Jason Rutherglen, Dean Wampler & Edward Capriolo, O'Reilly Publication.
2. "Programming in Pig", Alan Gates, O'Reilly Publication.
3. "HBase: The Definite Guide", Lars George, O'Reilly Publication.
4. "Apache Sqoop Cookbook" Kathleen Ting, Jarek Jarcec Cecho, O'Reilly Publication.

E-sources:

1. https://cognitiveclass.ai/courses/introduction-to-hadoop
2. https://cognitiveclass.ai/courses/course-v1:BDU+BD0133EN+v1
3. https://cognitiveclass.ai/courses/hadoop-hive
4. https://cognitiveclass.ai/courses/using-hbase-for-real-time-access-to-your-big-data
5. https://cognitiveclass.ai/courses/what-is-spark
6. Big Data Computing by PROF. RAJIV MISRA, Dept. of Computer Science and Engineering, IIT Patna. NPTEL COURSE.

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Course Code:	BTIT3101L	**Title:** Design and Analysis of Algorithms - Laboratory	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

To design and develop various algorithms and analyze its efficiency to a specific problem.

Suggestive List of Practical Assignments:

Sr. No. Name of Practical

1. Program to implement Heap sort.
2. Program to implement Insertion, bubble and selection sort.
3. Program to implement binary search algorithm using DnC method.
4. Program to implement maxmin algorithm using DnC method.
5. Program to implement merge sort algorithm using DnC method.
6. Program to implement a quick sort algorithm using DnC method.
7. Program to implement knapsack problem using greedy method.
8. Program to implement Job Sequencing with Deadlines using greedy method.
9. Program to implement Prim's/Kruskal's Algorithm using Greedy method.
10. Program to implement graph traversal technique: BFS.
11. Program to implement graph traversal technique: DFS.
12. Program to implement Sum of Subsets Algorithm using backtracking method

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Course Code:	BTIT3102L	**Title:** Information Retrieval - Laboratory	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Suggestive List of Practical Assignments:

Design, develop and implement the following Assignments

Sr. No. Name of Assignment

1. Representation of a Text Document in Vector Space Model and Computing Similarity between two documents.
2. Pre-processing of a Text Document: stop word removal and stemming.
3. Construction of an Inverted Index for a given document collection comprising of at least 50 documents with a total vocabulary size of at least 1000 words.
4. Classification of a set of Text Documents into known classes (You may use any of the Classification algorithms like Naive Bayes, Max Entropy, Rochio's, Support Vector Machine). Standard Datasets will have to be used to show the results.
5. Text Document Clustering using K-means. Demonstrate with a standard dataset and compute performance measures- Purity, Precision, Recall and F-measure.
6. Crawling/ Searching the Web to collect news stories on a specific topic (based on user input). The program should have an option to limit the crawling to certain selected websites only.
7. To parse XML text, generate Web graph and compute topic specific page rank
8. Matrix Decomposition and LSI for a standard dataset.
9. Mining Twitter to identify tweets for a specific period (and/or from a geographical location) and identify trends and named entities.
10. Implementation of PageRank on Scholarly Citation Network.

Implementations may be done in any programming language of your choice (say JAVA, Python or R).

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Course Code:	BTIT3103L	**Title:** Digital Image Processing - Laboratory	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Suggestive list of Practical

Sr. No. Name of Assignment

1. Image Enhancement using point processing methods
2. Apply Smoothing, Sharpening Spatial domain kernels on Images for Enhancement
3. Apply low pass and high pass frequency domain filters on Images for Enhancement.
4. Demonstration of Thresholding and Region Based Image Segmentation Methods .
5. Demonstration of Morphological image processing operations.
6. Programs for region description and boundary representation.
7. Program for object recognition
8. Case study : Group of 2-3 Students should study recent international journal research papers and present case study

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Course Code:	**BTIT3105L**	**Title: Elective - I (Laboratory)** **A. Basics of Blockchain**	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Suggestive List of Practical Assignments:

Design, develop and implement the following Assignments …….

Sr. No.	Name of Practical
1.	Introduction to Blockchain
2.	Understanding Blockchain use cases with real world examples
3.	Studying basics of Bitcoin and Cryptocurrency
4.	Studying BFT in distributed systems
5.	Studying various consensus algorithms: PoW, PoS, PBFT and PET
6.	Studying Hyperledger Fabric and setting up environment
7.	Studying Ethereum and setting up environment
8.	Understanding limitations of Blockchains
9.	Exploring various real world blockchain use cases
10.	Understanding Blockchain for e-governance

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Course Code:	**BTIT3106L**	**Title: Elective - I (Laboratory)** **B. Microprocessors, Microcontrollers and IoT Devices**	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination**	**03 Hrs**

		(Duration)	

Suggestive List of Practical Assignments:

Sr. No. Name of Practical

1. Basics of Internet of Things: Sensors, Actuators, IoT architecture and Gateway.
2. IoT Networking: Connectivity technologies, Protocols and Interoperability in IoT.
3. IoT application case study in home automation: IoT home application using Raspberry pi or Arduino OR nodeMCU.
4. Case study: IoT Application
5. Case Study: How to choose appropriate Microcontroller and microprocessor.
6. Case Study / Comparative Study: IoT Protocols

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Course Code:	**BTIT3107L**	**Title: Elective - I (Laboratory)** **C. Introduction to Big Data & Hadoop**	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination**	**03 Hrs**

		(Duration)	

Suggestive List of Practical Assignments:

Sr. No.Name of Practical

1. Installation of Hadoop in Single Node, Pseudo Distributed Mode
2. Hadoop: Installation of multi node cluster.
3. Implement the following file management tasks in Hadoop:
   a) Adding files and directories
   b) Retrieving files
   c) Deleting files
4. Write a Map Reduce program to count words from a given text file.
5. Perform a NOSQL analysis of a public data set using PIG Scripting.
6. Perform a NOSQL analysis of a public data set using HIVE Scripting.
7. Import data from a SQL database to HDFS using Sqoop
8. Install and Run Hbase then use HbaseDDl and DML commands
9. Case study: Hadoop and Hive at Facebook.
10. Case study: Study & Installation of Cloudera CDH

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Course Code:	BTIT3108P	**Title:** Soft skills	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

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Course Code:	BTIT3201	**Title:** Web Enabled Software Engineering	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	**-**	**Class Test:**	**20**

Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	1. To understand software lifecycle development models. 2. To understand and apply software requirements engineering techniques, software design principles, modeling and software testing techniques. 3. To understand the use of metrics in software engineering. 4. To understand software project management.
Course Outcomes	1. Aware of basic computer engineering concept through SDLC life cycle and Models in software engineering 2. Integrate the requirements from customers for software development. 3. Apply the design concept to develop the system. 4. Apply the basic software testing strategy. 5. Describe web engineering process 6. Formulate test strategy and ethically work to achieve the quality of product.
Pre-requisites	1. Students should have prior basic knowledge on Software attributes, Process models. 2. Students should have some basic knowledge on Testing, Maintenance.
Unit I: Software Development Process	Software crisis and myths, Software process and development: Generic view of process, Software life cycle and models, Analysis and comparison of various models, an agile view of process.
Unit II: Requirement Engineering	Requirements engineering tasks, initiating requirement engineering process, eliciting requirement, Building the analysis model, Negotiating and validating requirement, Building the analysis model.
Unit-III: System Design Overview	Design process and design quality, Design concepts, Design model, Pattern based software design, Architectural design, User interface design. UML: Different methods: Rambaugh / Booch / Jakobsons, Need for standardization. Developing diagrams in UML (Use CASE, Class, Interaction, and State Diagrams) CASE TOOLS.
Unit- IV: Validation and Testing	Strategic approach to Software testing, Strategic issues, Test strategies for conventional software, Validation testing, System testing, Debugging. White box testing and Black box testing.
Unit- V: Web	WebApps engineering layers, Web engineering processes planning for web

Engineering	engineering projects, Project management issue for web engineering. Metrics, Requirement analysis, Analysis models for web engineering design for WebApps, testing for WebApps.
Unit- VI: Planning and Management of Project	Project management, Metrics for process and projects, Estimation, Project scheduling, Risk management, Importance of software quality and measurements software engineering techniques for quality assurance, and Change management. ISO 9000 and CMM/ PCMM.

T*ext* Books:

1. Roger S. Pressman, "Software Engineering", Tata McGraw-Hill
2. G. Booch, J. Rambaugh, and I. Jacobson, "The Unified Modeling Language User Guide", Addison Wesley
3. K.K.Aggarwal , Yogesh Singh , "Software Engineering" , New Age International Publishers
4. Bruce Maxim, Roger Pressman , "Software Engineering: A Practitioner's Approach"

Reference Books:

1. Shari Pfleeger, "Software Engineering", Pearson Education
2. Ian Sommerville, "Software Engineering", Pearson Higher Education
3. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer New York
4. Mall Rajib,"Fundamentals of Software Engineering", PHI Learning

E-sources:

1. https://nptel.ac.in/courses/106/105/106105182/
2. http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=7

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Semester – VI

Course Code:	BTIT3202	**Title:** Computer Vision and Pattern recognition	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	**-**	**Class Test:**	**20**

Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	This course will enable students to 1. Understand computer vision and pattern recognition concepts, technologies, and algorithms. 2. Understand the underlying principle of Computer Vision and its usage in various applications. 3. Understand the underlying principle of Pattern Recognition and its usage in various applications.
Course Outcomes	After learning the course, the students should be able to: 1. Implement fundamental image processing techniques required for computer vision. 2. Develop applications using computer vision techniques. 3. Apply CV and PR algorithms to solve problems.
Pre-requisites	**Student should have knowledge of** 1. Image processing 2. Programming logic and design 3. Any programming language like C/C++/Java/Python/Matlab
Unit 1: Introduction to computer vision	Sensing, seeing, and perceiving, Role of vision, Images, Sources of imagery, The physics of imaging. Geometry of Image Formation, Representing, acquiring, and displaying images, Grayscale, color, noise, lens distortion, and filtering.
Unit 2: Image and image processing	Image Formation and Coordinate Transformations, Camera Matrix, Motion/Stereo Pin-hole model, Human eye / cognitive aspects of colour / 3D space; illumination, Sampling and Quantization, Coordinate transformations and camera parameters, Image processing, pre-processing, and image correction. Enhancing features and correcting imperfections, noise.
Unit 3: Image classification and clustering	Image classification and clustering, Linear classification, Higher-level representations, Object detection, Bag of words, Object recognition/categorization, Segmentation, Applications: Surveillance, Object detection, etc
Unit 4: Introduction to Pattern Recognition	Bayes Decision Theory: Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, discrete features. Linear discriminant functions: Gradient descent procedures; Perceptron; Support vector machines
Unit 5: Parameter Estimation Methods 1	Maximum-Likelihood estimation: Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation.
Unit 6: Parameter	Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition.

Estimation Methods 2	Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbor method.

T*ext* Books:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006
4. Richard Szeliski, Computer Vision Algorithms and Applications, Springer, 2010.

Reference Books:

1. Simon Prince, "Computer Vision: Models, Learning and Inference", Cambridge University Press, 2012
2. Robert Schalkoff. "Digital Image Processing and Computer Vision", Wiley and sons, 1989
3. Manas Kamal Bhuyan, "Computer Vision and Image Processing Fundamentals and Applications" CRC press 2019.
4. Wang, Chen, Pau. "Handbook of Pattern Recognition and Computer Vision". World Scientific Pub Co . 1993.

E-sources:

1. Coursera courses on Computer Vision and Pattern Recognition.
2. Edx courses on Computer Vision and Pattern Recognition
3. Udemy courses on Computer Vision and Pattern Recognition.
4. NPTEL/SWAYAM courses on Computer Vision and Pattern Recognition

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Semester – VI

Course Code:	BTIT3203	**Title:** Information Theory and Coding	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	**-**	**Class Test:**	**20**

Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	This course will enable students to introduce information theory, the fundamentals of error control coding techniques and their applications, and basic cryptography.
Course Outcomes	After learning the course, the students should be able: 1. Explain the basic notions of information and channel capacity. 2. Explain Linear block codes, decoding techniques, error control coding techniques. 3. Explain cyclic codes, decoding techniques, error control coding techniques. 4. Explain convolutional codes, decoding techniques, error control coding techniques. 5. Explain automatic repeat request (ARQ) schemes.
Pre-requisites	Probability and Random Processes, Digital Communications.
UNIT 1: Information Theory	Uncertainty, Information, Entropy, Discrete Memoryless Channel, Mutual Information, Channel Capacity, Shannon's Theorems, Gaussian Channel, Limits to Communication
UNIT 2: Linear Block Codes	Groups, Fields and Vector Spaces Construction of Galois Fields of Prime Order, Syndrome Error Detection Standard Array and Syndrome Decoding Hamming Codes
UNIT 3: Cyclic Codes	Polynomial Representation Codewords, Generator Polynomial Systematic Codes, Generator Matrix, Syndrome Calculation and Error Detection, Decoding of Cyclic Codes
UNIT 4: Structure and Properties of Convolutional Codes	Convolutional Encoder Representation Tree, Trellis, and State Diagrams Distance Properties of Convolutional Codes Punctured Convolutional Codes and Rate Compatible Schemes
UNIT 5: Decoding of Convolutional Codes	Maximum Likelihood Detection, The Viterbi Algorithm
UNIT 6: Automatic Repeat Request	Basic Techniques, Hybrid ARQ

Strategies	

T*ext* Books:

1. Jorge Castiñeira Moreira, Patrick Guy Farrell , "Essentials of Error-Control Coding" John Wiley, 2006. ISBN: 978-0-470-02920-6.
2. R Bose, "Information Theory, Coding and Cryptography", TMH 2007
3. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education Asia, 2002.
4. Mark Kelbert,"Information Theory and Coding by Example", 1st Edition.

Reference Books:

1. Dominic Welsh, Codes and Cryptography, Oxford Science Publications, 1988.
2. K Sayood, "Introduction to Data Compression" 3/e, Elsevier 2006
3. S Gravano, "Introduction to Error Control Codes", Oxford University Press 2007
4. Amitabha Bhattacharya, "Digital Communication", TMH 2006

E-sources:

NPTEL free online course material, video lectures on information theory and coding

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Semester – VI

Course Code:	**BTIT3204**	**Title:** Elective - II: A. Smart Contract	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**

Tutorial	-	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	1. **To introduce smart contract concepts** 2. **To understand Practical use of cryptocurrency and best practices** 3. **To install and use Solidity Software for Creating Contracts** 4. **To install and use Ethereum for Smart Contracts** 5. **To create Awareness regarding Security** 6. **To identify Security and Trust issues in Smart Contracts**
Course Outcomes	After learning the course, the student will be able: 1. **To justify importance of Smart Contracts** 2. **To install and use Solidity Framework** 3. **To create a simple program and write functions** 4. **To write program for creating contracts** 5. **To do error handling and debugging**
Pre-requisites	**1. Expertise in Programming** **2. Cryptography, Networking Basic** **3. Knowledge of Computer Security**
	SECTION-A
Unit 1: Smart Contract & Blockchain Basics	Smart Contract Basics: Defining Smart Contracts, Advantages of Smart Contracts, Challenges in implementing and negotiating with non-technical users. Blockchain Basic: Introduction, Basic Cryptographic primitives used in Blockchain – Secure, Collison-resistant hash functions, digital signature, public key cryptosystems, zero-knowledge proof systems, Using smart contracts to enforce legal contracts**.**
Unit 2: Solidity & Ethereum Virtual Machine	Industry applications for smart contracts, Basics of Solidity, Structure, Basic Data Types & Statements, Ethereum Virtual Machine, Transactions, Storage, Memory, and the Stack, Comparing Bitcoin scripting vs. Ethereum Smart Contracts.
Unit 3: Installing the Solidity Compiler	Installing with Different Tech Stack: Versioning, Remix, Node etc., Layout of a Solidity Source File, Structure of Contract, types, Units & Globally Available Structures, Contracts.
	SECTION-B
Unit 4: Using Ethereum For Creating Smart	Intro to Ethereum, Intro to DAPPS, Web2 Vs Web3, Accounts, Transactions, EVM, Gas, Nodes & Clients, Networks, Ethereum Smart Contracts, Development

Contract	Frameworks.
Unit 5: Trust, Security & Efficiency	Trust, Security & Efficiency of Smart Contracts "in the field", Market impact & scientific innovation of Smart Contract, Constructing Future-resistant systems using Smart Contracts, The double importance of Security in Smart Contracts, Famous smart-contract-related hacks (DAO)
Unit 6: Security Issues in Smart Contract	Shifting from Trust-in-People to Trust-in-Code, Data permanence in Smart Contract transaction, Selective-Obscurity in Smart Contract data, Quantum readiness of your Smart Contract, Smart Contract End of Life: staying agile, Forks (Hard & Soft) and community security counter measures against Smart Contract exploit.

T*ext* Books:

1. Mastering Ethereum: Building Smart Contracts and Dapps
2. Solidity Programming Essentials: A beginner's guide to build smart contracts for Ethereum and blockchain
3. Smart Contract Development with Solidity and Ethereum: Building Smart Contracts with the Azure Blockchain

Reference Books:

1. Blockchain: The Untapped Goldmine Of Blockchain That Virtually No One Knows About: Alex Barnett, Writers International Publishing
2. A Beginner's Journey to Ethereum's Smart Contracts Engineering Smart Contracts and DApps in Solidity and Web3.Js: Mr. Peter Namisiko Wanjala PNW
3. Ethereum Smart Contract Development Build blockchain-based decentralized applications using solidity: Mayukh Mukhopadhyay

E-sources:

1. https://www.coursera.org/learn/smarter-contracts#about
2. https://soliditylang.org

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Course Code:	BTIT3205	**Title:** Elective - II: B. IoT Communications	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**

Tutorial	**-**	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	The Internet is evolving to connect people to physical things and also physical things to other physical things all in real time. It's becoming the Internet of Things (IoT). The course enables student to understand the basics of Internet of things and protocols. Introduces some of the application areas where Internet of Things can be applied. Students will learn about the middleware for Internet of Things. To understand the concepts of Web of Things
Course Outcomes	After learning the course, the student will be able: **1.** Able to understand the application areas of IOT **2.** Able to understand building blocks of Internet of Things and characteristics 3. identify the Components that forms part of IoT Architecture 4. Determine the most appropriate IoT Devices and Sensors based on Case Studies 5. Setup the connections between the Devices and Sensors
Pre-requisites	1) Basic of Electrical & Electronics 2) Digital Electronics & Microcontroller 3) Fundamentals of computer network 4) Network Security & Internet technology
	SECTION-A
Unit 1 Introduction	Understanding IoT fundamentals, IoT Architecture and protocols, Characteristics of IoT , IoT levels, Various Platforms for IoT, Real time Examples of IoT, Overview of IoT components & IoT Communication Technologies, IoT vs M2M, Challenges in IoT, IoT Applications.
Unit 2 Sensors	Classification of Sensors, Working Principle of Sensors, Analog and Digital Sensors, Criteria to choose a Sensor, Generation of Sensors, Actuators, Relay Switch, Servo Motor.
Unit 3 IoT Design Methodology	Design methodology, Challenges in IoT Design, IoT System Management, IoT Servers.
Unit 4 Arduino Simulation Environment	Microcontrollers , Arduino Uno Architecture , Arduino Boards, Setup the IDE, Writing Arduino program, The Arduino Sketch, Some Basic Examples, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino , Interfacing Arduino with LCD.
	SECTION-B

Unit 5 Sensor & Actuators with Arduino	Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino, Interfacing of Actuators with Arduino, Interfacing of Relay Switch and Servo Motor with Arduino.
Unit 6	Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, implications of an operating system on the behavior of the Raspberry Pi as an IoT device, booting Raspberry Pi 3, Downloading an Operating System, format an SD card and booting the OS. Basics of Linux and its use, main features including navigating the file system and managing processes, text-based user interface through the shell, overview of the graphic user interface for Raspian Linux distribution
Unit 7 Interfacing Hardware with the Raspberry Pi.	Raspberry Pi Remote Access, operate the Raspberry Pi in "headless mode", Bash Command line, operating Raspberry Pi without needing a GUI interface, Basics of the Python programming language, programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.
Unit 8 Communication	Communication with devices through the pins of the Raspberry Pi, RPi.GPIO library, Python Functions, setting up the pins, General purpose IO Pins, Protocol Pins, GPIO Access, applying digital voltages, and generating Pulse Width Modulated signals, Tkinter Python library, accessing pins through a graphic user interface.

T*ext* Books:

1) Internet of Things with Raspberry Pi and Arduino By Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, ISBN 9780367248215 Published November 12, 2019 by CRC Press.
2) **IoT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT Kindle Edition by David Etter (Author) Format: Kindle Edition**
3) Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", January 2012, McGraw Hill Professional.
4) Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach" Orient Blackswan Pvt. Ltd., New Delhi, 2015.

Reference Books:

1) Eben Upton and Gareth Halfacree, "Raspberry Pi User Guide", August 2016, 4th edition, John Wiley & Sons
2) Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", Feb 2014, John Wiley & Sons

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Semester – V

Course Code:	BTIT3206	**Title:** Elective – II : C. Introduction to Apache, Spark & Scala	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**

Tutorial	**-**	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	1. To know the fundamental concepts of Scala Programming. 2. To understand concepts of Spark. 3. To explore Spark components and practices for working with big data. 4. To know about the research that requires the integration of large amounts of data
Course Outcomes	**Course Outcomes:** After learning the course, the student will be able: **1. Abc** **2. Abc** **3. Abc** **4. Abc** **5. Abc**
Pre-requisites	**1.** Students should have the knowledge of OOPs Concepts. **2.** Student should have hands-on knowledge about Linux Operating Systems.
	SECTION-A
Unit 1: Introduction to Big Data Hadoop and Spark	What is Big Data? Limitations and Solutions of Existing Data Analytics Architecture with Uber Use Case, Big Data Customer Scenarios, How Hadoop Solves the Big Data Problem?, What is Hadoop?, Hadoop's Key Characteristics, Hadoop Ecosystem, Hadoop Core Components, HDFS, YARN and its Advantage, Rack Awareness and Block Replication, Big Data Analytics with Batch & Real-time Processing, Why Spark is needed?, What is Spark? Spark at Yahoo!, How Spark differs from other frameworks?
Unit 2: Introduction to Scala and Apache Spark	What is Scala? Why Scala for Spark?, Scala in other Frameworks, Introduction to Scala REPL, Basic Scala Operations, Variable Types in Scala, Control Structures in Scala, Foreach loop, Functions and Procedures, Collections in Scala- Array, ArrayBuffer, Map, Tuples, Lists.
Unit 3: Functional Programming	Functional Programming, Higher Order Functions, Anonymous Functions, Class in Scala, Getters and Setters, Custom Getters and Setters, Properties with only Getters, Auxiliary Constructor and Primary Constructor, Singletons, extending a

and OOPs Concepts in Scala	Class, Overriding Methods, Traits as Interfaces and Layered Traits.
	SECTION-B
Unit 4: Deep Dive into Apache Spark Framework	Spark's Place in Hadoop Ecosystem, Spark Components & its Architecture, Spark Deployment Modes, Introduction to Spark Shell, writing your first Spark Job Using SBT, Submitting Spark Job, Spark Web UI, Data Ingestion using Sqoop.
Unit 5: Playing with Spark RDDs	Challenges in Existing Computing Methods, Probable Solution & How RDD Solves the Problem, what is RDD, It's Functions, Transformations & Actions? Data Loading and Saving Through RDDs, Key-Value Pair RDDs, Other Pair RDDs, RDD Lineage, RDD Persistence, WordCount Program Using RDD Concepts, RDD Partitioning & How It Helps, Achieve Parallelization, Passing Functions to Spark.
Unit 6: DataFrames and Spark SQL	Need for Spark SQL, What is Spark SQL? Spark SQL Architecture, SQL Context in Spark SQL, User Defined Functions, Data Frames & Datasets, Interoperating with RDDs, JSON and Parquet File Formats, Loading Data through Different Sources, Spark – Hive Integration.

T*ext* Books:

1. "Scala Programming for Big Data Analytics", Irfan Elahi, Apress.
2. "Practical Apache Spark Using the Scala API", Subhashini Chellappan, Dharanitharan Ganesan, Apress

Reference Books:

1. "Scala and Spark for Big Data Analytics", Md. Rezaul Karim, Sridhar Alla, Packt Publication.

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Semester – V

Course Code:	BTIT3207	**Title:** Elective - III: A. Decrentralised Applications	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**
Tutorial	**-**	**Class Test:**	**20**

Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	**1. Explain what are decentralized applications (Dapps)** **2. Understand use cases and limitations of Dapps** **3. Describe how to set up environment to run Daaps** **4. Learning Tuffle Development** **5. Learning programming in solidity and Etherium to create Dapps** **6. Studying real world case study of Spotify**
Course Outcomes	After learning the course, the student will be able: **1. Learn basic concepts of Dapps** **2. Learning the suitable use cases for Dapps** **3. Developing simple Daaps considering an example use case** **4. Learning Tuffle IDE** **5. Learning Solidity and Etherium platform** **6. Evaluate potential Dapps uses cases from a business, legal, and engineering perspective**
Pre-requisites	**1. Basics of Blockchain technology.** **2. Basic Knowledge of Internet of Things, Computer Security, Cryptography.** **3. Knowledge of Programming languages like javascript, Python, C++, Java**
	SECTION-A
Unit 1:	Introduction to Decentralized Apps (Dapps), Understanding Dapps, History of Dapps, Definition, Decentralized Application Architecture, Classification of Dapps, Operations of Dapps, Etherium APIs.
Unit 2:	Decentralized Apps – Coding Details,State Machine, Etherium Virtual machine, Coding Style Guide, Design Patterns, Code Layout, Naming Conventions, Common Design Patterns, Withdrawal from Contracts.
Unit 3:	Programming Smart Contracts: Understanding of solidity programming, Solidity Features, Data Types, Functions, Inheritance, Error Handling, Event Handling, Oraclize.
	SECTION-B
Unit 4:	Setting Up: Truffle Suite Ganache/Geth,Metamask, Remix Environment, Remix IDE, Truffle IDE ,Web Interface: Web3.js, Test-Driven Development, Testing.
Unit 5:	Auction and mining contract: Running smart contract, Deployment of the Smart contract , Simple auction contract, blind auction contract, mining Ether, purpose of crypto economics.
Unit 6:	**Case studies 0f Dapps : spotify**

T*ext* Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies : a comprehensive introduction. Princeton University Press, 2016

Reference Books:

1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
3. Mastering Ethereum, Mastering Bitcoin, and The internet of Money (all 3 volumes)- by Andreas Antonopoulos

E-sources:

1. https://nptel.ac.in

2. https://www.coursera.org

3. https://www.youtube.com/channel/UCY0xL8V6NzzFcwzHCgB8orQ

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Semester – VI

Course Code:	BTIT3208	**Title:** Elective - III: B. IoT Networking	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**

Tutorial	-	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	1) To Understand the various IoT Protocols 2) Networking Between the devices 3) Study of IoT Network Architecture 4) Study Smart IoT Connected Cities
Course Outcomes	After learning the course, the student will be able: 1) Interface Arduino with wireless devices 2) Understand the smart object 3) Connecting the smart object with IoT *4)* Understand the IoT Network Architecture
Pre-requisites	1) Arduino & Raspberry Pi Controller Programming 2) Networking Technologies 3) Fundamentals of computer network, 4) Network Security & Internet technology.
	SECTION-A
Unit 1 Arduino-Interface	Arduino-Ethernet Interface**,** Connect Arduino using the Ethernet, Arduino Ethernet Library, Simple Ethernet Client Example, Simple Ethernet Server Example, Arduino using the Wi-Fi Connect Arduino using the Wi-Fi, WiShield Library, WiFly Shield Library, Using the Arduino Library for Processing.
Unit 2 Basic Networking with ESP8266 Wi-Fi module	Basics of Wireless Networking ,Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi library, Web server- introduction, installation, configuration, Posting sensor(s) data to web server, Introduction to ESP8266 NodeMCU Module , Pin out, Block diagram.
Unit 3 IoT Network Architecture and Design	Drivers Behind New Network Architectures, Comparing IoT Architectures, oneM2M, IoT World Forum (IoTWF) Standardized Architecture, IT and OT Responsibilities in the IoT Reference Model, A Simplified IoT Architecture, Core IoT Functional Stack, IoT Data Management and Compute Stack.
Unit 4 Smart Objects: The "Things" in IoT	Sensors, Actuators, Micro-Electro-Mechanical Systems (MEMS), Smart Objects, Sensor Networks, Wireless Sensor Networks (WSNs), Communication Protocols for Wireless Sensor Networks.
	SECTION-B
Unit 5 Connecting Smart Objects	Communications Criteria, IoT Access Technologies, IEEE 802.15.4, Standardization and Alliances, Physical Layer, MAC Layer, Topology, Security.

Unit 6 IP as the IoT Network Layer	Key Advantages of Internet Protocol, Adoption or Adaptation of the Internet Protocol, Need for Optimization, Optimizing IP for IoT.
Unit 7 Smart and Connected Cities	An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.
Unit 8 Public Safety	Overview of Public Safety, An IoT Blueprint for Public Safety, Emergency Response IoT Architecture, IoT Public Safety Information Processing, School Bus Safety.

T*ext* Books:

1) IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017 ,by Hanes David (Author), Salgueiro Gonzalo (Author), Grossetete Patrick (Author), Barton Rob
2) Internet of Things with Raspberry Pi and Arduino By Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, ISBN 9780367248215 Published November 12, 2019 by CRC Press.
3) **IoT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT Kindle Edition by** David Etter **(Author) Format: Kindle Edition**
4) Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach" Orient Blackswan Pvt. Ltd., New Delhi, 2015

Reference Books:

1) Eben Upton and Gareth Halfacree, "Raspberry Pi User Guide", August 2016, 4th edition, John Wiley & Sons
2) Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", Feb 2014, John Wiley & Sons

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Semester – VI

Course Code:	BTIT3209	**Title:** Elective - III: C. Natural Language Processing using Python	
Teaching Scheme		**Examination Scheme**	
Theory:	**3**	**Mid Semester:**	**20**

Tutorial	-	**Class Test:**	**20**
Total credits:	**3**	**End Semester:**	**60**
		Duration of theory paper:	**3 Hrs.**

Course Objectives	1. Enable the students to recognize significance of natural language processing in solving real-world problems. 2. Enable them to map the appropriate processing technique to a problem and implement the technique. 3. Teach students the state-of-art natural language processing techniques.
Course Outcomes	After learning the course, the student will be able: 1. To describe the fundamental concepts and techniques of natural language processing. 2. To distinguish among the various techniques. 3. To use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions. 4. To analyse large volume text data generated from a range of real-world applications.
Pre-requisites	1. Data Structure and Algorithms 2. Foundations of Machine Learning
	SECTION-A
Unit 1: Introduction	Overview of Language Processing, Ambiguity, Stages of Language Processing, Regular expressions, Words, Sentences, Corpora.
Unit 2: Language Models	The role of language models, Simple N-gram models, estimating parameters and smoothing, Evaluating language models, Long distance dependencies.
Unit 3: Part-of-Speech Tagging	Overview of Part-of-Speech (POS) Tagging, POS Tagging Approaches, Markov Model for POS, HMM for POS, HMM generation procedure, HMM learning.
	SECTION-B
Unit 4: Syntactic Parsing	Context-Free Grammars, Sentence generation, Recursive Descent parsing, Shift Reduce parsing, CKY parsing, Syntactic ambiguity, Probabilistic Context-Free Grammars, Statistical parsing using treebanks.
Unit 5: Maximum Entropy Models	Generative vs. discriminative models, optimizing softmax/maxent model parameters, Named Entity Recognition, Maximum entropy sequence models, Smoothing.
Unit 6: Deep Learning for NLP	Deep Learning and its architectures, Word representations, Unsupervised word vector learning, Learning word-level classifiers, Recurrent Neural Network.

T*ext* Books:

1. Dan Jurafsky and James H. Martin, “Speech and Language Processing”, 3rd edition draft, 2020

Reference Books:

1. Christopher D. Manning and Hinrich Schütze, “Foundations of Statistical Natural Language Processing”, MIT Press, 1999.
2. James Allen, “Natural Language Understanding”, Benjamin/Cummings, 2nd edition, 1995.

E-sources:

1. https://web.stanford.edu/class/cs224s/
2. https://www.cs.utexas.edu/~mooney/cs388/welcome.html
3. https://www.learn.ed.ac.uk/webapps/blackboard/content/listContent.jsp?course_id=_80826_1&content_id=_4802918_1
4. http://www.nltk.org/book/
5. www.machinelearningplus.com/nlp/natural-language-processing-guide

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Semester – VI

Course Code:	BTIT3201L	**Title:** Web Enabled Software Engineering - Practical	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination**	**03 Hrs**

		(Duration)	

Sr. No. Name of Practical

1. Study of SRS
2. Write a program in C for Matrix multiplication and check its failure also introspect the causes for its failure and write down the possible reasons for its failure
3. Take system ATM system and study its system specifications and draw the various UML diagram
4. Take system Banking application and study its system specifications and draw the various UML diagram
5. Take system Library system and study its system specifications and draw the various UML diagram
6. Study of any bug UML tool

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Course Code:	BTIT3202L	**Title:** Computer Vision and Pattern recognition - Practical	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**

Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Sr. No. Name of Practical

1. Design and implement a neural network for digit classification. Compute precision, recall and accuracy.
2. Design and implement a Naïve Bayes classifier for classification of documents. Compute precision, recall and accuracy.
3. Design and implement a supervised classification method for a two-class problem. Compute confusion matrix, precision, recall and accuracy.
4. Design and implement a supervised classification method for a multi-class problem. Compute confusion matrix, precision, recall and accuracy.
5. Design and implement an unsupervised classification method for a two-class problem. Compute confusion matrix, precision, recall and accuracy.
6. Design and implement an unsupervised classification method for a multi-class problem. Compute confusion matrix, precision, recall and accuracy.
7. Design and implement a convolutional neural network with more than 2 layers for a classification problem. Compute confusion matrix, precision, recall and accuracy.
8. Design and implement a deep convolutional neural network for a classification problem. Compute confusion matrix, precision, recall and accuracy. Discuss impact of parameter tuning on accuracy.
9. Design and implement a deep convolutional NN to solve any computer vision problem. Compute accuracies.
10. Design and implement a deep convolutional NN to solve any NLP problem. Compute accuracies.

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Semester – VI

Course Code:	BTIT3203L	**Title:** Information Theory and Coding - Practical	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**

Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Sr. No. Name of Practical

1. Develop a program to implement the algorithm of Encoding of messages.
2. Develop a program to Compute the Entropy in case of Discrete Algorithm.
3. Develop a program to Compute Entropy of 4 Parts of Message
4. To write a program to find the Entropy of certain message.in C++
5. Develop and Implement Program to Compute the Capacity of Noiseless Binary Channel
6. Can computing Binary Entropy Function (Channel Capacity) as C=1-H(p).
Write Program for BSC when px=0.1 find the Hp= 0.468 ~ 0.47 and Capacity= 0.53~0.531.
7. Can Computing BSC (Channel Capacity) in Private Case Study As I(X:Y)=H(Y)-H(Y|X) .
Write Program For BSC of Private Case Study To Compute Capacity.
8. A simple example will be used to illustrate the Shannon Fano algorithm ..
9. A simple example will be programmed in C++ for Huffman Coding algorithm.

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Course Code:	BTIT3204L	**Title:** Elective - II – Practical : A. Smart Contract	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**

Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Sr. No. Name of Practical

1. Introduction to Blockchain, Ethereum & Solidity framework.
2. To install and Study Configuration procedures of Solidity framework.
3. To study Basic Data Types & Statements (Bidder Data & Functions Demos).
4. To study State Variables, Functions, Events.
5. To study Error Handling, Ether Units, Time Units.
6. To study Internal & External Function Call.
7. To study how to create Contract, Visibility & Getters.
8. To implement Inheritance in Solidity.
9. To study Abstract Contract & Interfaces.
10. To create Inline Assembly using Solidity framework.

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Course Code:	BTIT3205L	**Title:** Elective - II – Practical: B. IoT Communications	
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**

Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Sr. No. Name of Practical

1. Introduction to various sensors and various actuators & its Application (Students have to prepare Report for the same).

2. Perform Experiment using Arduino Uno to measure the distance of any object using Ultrasonic Sensor
3. Create a circuit using Arduino and sensors. Perform experiment using Arduino Uno to Learn Working of Servo Motor.
4. Program to interface Push button/Digital sensor with Arduino and write a program to turn On /Off LED when Push button is pressed.
5. To Interface DHT11 sensor with Arduino and write a program to print temperature and humanity reading.
6. Understanding GPIO pins on Raspberry Pi board and its use in program.
7. Write a program to interface Buzzer and LED at different GPIO pins, write delay routine and generate 10 different patterns using Raspberry Pi.

8. Write a program to interface Motion Sensor, IR sensor using Raspberry Pi.
9. Creating a webpage and display the values available through Arduino Demonstration of Setup & Working of Raspberry Pi.
10. To create a database & store the value in Raspberry Pi.
11. Studying Connectivity and Configuration of Raspberry Pi board with basic peripherals.
12. Understanding the connectivity of Raspberry Pi board with camera. Writing an application to capture and store the image.

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Course Code:	BTIT3206L	**Title:** Elective - II - Practical: C. Introduction to Apache, Spark & Scala
Teaching Scheme		**Examination Scheme**

Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Sr. No. Name of Practical

1. Installation of Scala and creating a Hello World in Scala REPL.
2. Programs on Variables, Data Types, Conditional Statements in Scala.
3. Programs on creating Functions, Invoking Functions, and Passing Functions as arguments.
4. Write a program on Lists, Map, Tuples and various operations on Lists, Map, Tuples.
5. Write a program on Loops (for, while and foreach).
6. Write a program on creating Classes, objects and Method Overriding
7. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.
8. Write a program for creating an RDD and apply various transformation and actions.
9. Write a wordcount program on spark using RDDs.
10. Write a program for creating DataFrames and perform certain Sparksql operations (DDL and DML) on the DataFrames.

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Semester – VI

Course Code:	BTIT3207L	**Title:** Elective - III - Practical: A. Decrentralised Applications
Teaching Scheme		**Examination Scheme**

Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Sr. No. Name of Practical

1. Introduction to Blockchain, Ethereum & Solidity framework.
2. To install and Study Configuration procedures of Solidity framework.
3. To study Basic Data Types & Statements (Bidder Data & Functions Demos).
4. To study State Variables, Functions, Events.
5. To study Error Handling, Ether Units, Time Units.
6. To study Internal & External Function Call.
7. To study how to create Contract, Visibility & Getters.
8. To implement Inheritance in Solidity.
9. To study Abstract Contract & Interfaces.
10. To create Inline Assembly using Solidity framework.

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Course Code:	BTIT3208L	**Title:** Elective - III - Practical: B. IoT Networking
Teaching Scheme		**Examination Scheme**

Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Sr. No. Name of Practical

1. Check the Bluetooth module along and explore the possibility of pairing with Android Smart Phone.
2. Identify interfacing of wireless modules with IoT platform
3. Turn your smartphone into an IoT device using the IBM Watson IoT Platform cloud-hosted service.
4. Test Bluetooth module with a micro controller and Program to switch on/off an LED/Buzzer using Blynk Application
5. To study of IoT Data Logging using Beaglebone Black and Thingspeak.
6. Demonstrate NodeMCU and its working & Getting Started with ESP8266 Wi-Fi Module
7. Explore the interfacing of Zigbee module to create wireless sensor network
8. Explore the interfacing of GSM module to make node as a gateway.
9. ESP8266 Client-Server Wi-Fi Communication between Two Boards (NodeMCU)
10. Create Simple ESP8266 NodeMCU Web server in Arduino IDE
11. Log sensor data to Google sheets using NodeMCU
12. Controlling devices by using Wi-Fi Module ESP8266 NodeMCU through THINGER.IO

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Course Code:	BTIT3209L	**Title:** Elective - III - Practical: C. Natural Language Processing using Python
Teaching Scheme		**Examination Scheme**

Practical :	**2 Hrs./Week**	**Practical /Oral Examination**	**50 Marks**
Total credits :	**1**	**Practical /Oral Examination (Duration)**	**03 Hrs**

Sr. No. Name of Practical

1. Morphology
2. Word frequency analyzer
3. N-Gram model
4. POS tagging: Hidden Markov Model
5. POS tagging: Viterbi Decoding
6. Chunker
7. Syntactic parsing
8. Named Entity Recognition (NER) tasks
9. Text classifier
10. Chatbot