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B.TECH - COMPUTER SCIENCE AND ENGINEERING
COURSE STRUCTURE R22

SEMESTER VII

S.No	Course Class.	Course Code	Name of the subject	L	T	P	C	I	E	Total
1	PC	D57PC22	Deep Learning	3	0	0	3	40	60	100
2	PC	D57PC23	Network Security and Cryptography	3	0	0	3	40	60	100
3	PE	D57PE5	**Professional Elective V**	3	0	0	3	40	60	100
			A. Robotic Process Automation							
			B. Quantum Computing							
			C. Reinforcement Learning							
			D.Medical Image Processing							
4	OE	D57OE2	Open Elective II	3	0	0	3	40	60	100
5	PC	D57PC24	Deep Learning Lab	0	0	2	1	40	60	100
6	PW	D57PW1	Project Work Phase 1	0	0	14	7	100	--	100
7	MC	MC004	MOOCS/Online Course							
TOTAL				**12**	**0**	**16**	**20**	**300**	**300**	**600**

SEMESTER VIII

S.No.	Course Class.	Course Code	Name of the subject	L	T	P	C	I	E	Total
1	PC	D58PC25	Blockchain Technologies	3	0	0	3	40	60	100
2	PE	D58PE6	**Professional Elective VI**	3	0	0	3	40	60	100
			A. Web and Social Media Analystics							
			B. Video Analytics							
			C. Natural Language Processing							
			D.Cyber Forensics							
3	OE	D58OE3	Open Elective III	3	0	0	3	40	60	100
4	OE	D58OE4	Open Elective IV	3	0	0	3	40	60	100
5	PW	D58PW2	Major Project Phase 2	0	0	16	8	40	60	100
TOTAL				**12**	**0**	**16**	**20**	**200**	**300**	**500**

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COMPUTER SCIENCE AND ENGINEERING

Semester VII **L/T/P C**
3/0/0 3

DEEP LEARNING (D57PC22)

Course Objectives:
To provide students with an in-depth understanding of deep learning techniques and their applications.

Course Outcomes:
Upon completion of this course the students will be able to :
1. Analyze Machine Learning algorithms and apply the knowledge of deep feed forward networks for a given problem scenario. L4
2. Make use of regularization techniques and optimization strategies to train deep models for a given problem. L3
3. Compare and contrast different variants of the basic convolution function, and analyze their applicability in different contexts. L4
4. Analyze recurrent neural networks (RNNs) to model sequential data and implement LSTM and other gated RNN architectures to address the vanishing gradient problem and capture long-term dependencies. L4
5. Analyze the effectiveness of default baseline models in various applications, including multi-digit number recognition, utilizing practical methodology and performance metrics. L4

UNIT I
Machine Learning Basics:
Learning Algorithms, Capacity, Overfitting and Under fitting , Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, Building a Machine Learning Algorithm, Challenges Motivating Deep Learning, Deep Feed forward Networks Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

UNIT II
Regularization for Deep Learning:
Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop, and Manifold Tangent Classifier, Optimization for Training Deep Models, Learning vs Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates.

UNIT III

Convolutional Networks:

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features.

UNIT IV

Recurrent and Recursive Nets:

Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long Term Dependencies, Explicit Memory.

UNIT V

Practical Methodology:

Performance Metrics, Default Baseline Models, Determining Whether to
Gather More Data, Selecting Hyper parameters, Debugging Strategies, Example: Multi-Digit Number Recognition Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.

Text Book:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.

Reference Books:

1. The Elements of Statistical Learning. Hastie, R. Tibshirani, and J. Friedman, Springer.
2. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.
3. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.
4. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
5. Golub, G., H., and Van Loan, C.,F., Matrix Computations, JHU Press, 2013.
6. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004

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COMPUTER SCIENCE AND ENGINEERING

Semester VII **L/T/P C**
3/0/0
3

NETWORK SECURITY AND CRYPTOGRAPHY (D57PC23)

Course Objective:
To provide students with an in-depth understanding of fundamental concepts of symmetric and asymmetric cipher models, concepts of authentication, network security and web security protocols.

Course Outcomes:
Upon completion of this course the students will be able to :
1. Identify various security approaches and Cryptography Concepts and Techniques to ensure secure communication and data protection. L3
2. Compare & contrast the different symmetric and asymmetric key ciphers- L4
3. Identify different cryptographic hash functions – L3
4. Analyze IPsec protocols effectively, to ensure comprehensive protection for IP communication. L4
5. Compare and contrast different web security considerations- L4

UNIT I
Security Concepts:
Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security, Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography.

UNIT II
Symmetric key Asymmetric Ciphers:
Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange.

UNIT III
Cryptographic Hash Functions:
Message Authentication, MD5, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, Digital signatures, Digital Signature Scheme. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure

UNIT IV
IP Security:
IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, combining security associations, Internet Key Exchange.

UNIT V

Web Security:

Web security considerations, Pretty Good Privacy, S/MIME, Secure Socket Layer Transport Layer Security and Secure Electronic Transaction.

Text Book:

1. Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition.

Reference Books:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R PadmanabhanWiley India, 1st Edition.
2. Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

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COMPUTER SCIENCE AND ENGINEERING

Semester VII **L/T/P C**
3/0/0 3

ROBOTIC PROCESS AUTOMATION (D57PE5A)

Course Objectives:
To equip students with practical skills in Robotic Process Automation (RPA) using UiPath, RPA tool.

Course Outcomes:
Upon completion of this course the students will be able to :

1. Apply the knowledge of UiPath software components, including UiPath Studio, UiPath Robot, and UiPath Orchestrator, to create, manage, and orchestrate RPA processes efficiently. L3
2. Apply sequencing, flowcharting, and control flow concepts to design and implement workflows, incorporating various activities, loops, and decision-making structures to control program execution.. L3
3. Applying UIPath tool for debugging process. L3
4. Develop system managing techniques. L3
5. Analyze application for process automation using UIPath tool. L4

UNIT I
Robotic Process Automation:
Introduction, Scope and techniques of automation, Robotic process automation, Components of RPA, RPA platforms, About UiPath,UiPath Stack, Uipath Studio, Uipath Robot, Types of Robots, UiPath Orchestrator, UiPath Studio Projects, User interface.
The User Interface:
Task recorder, Advanced UI interactions: Input methods, Output methods

UNIT II
Sequence, Flowchart, and Control Flow:
Sequencing the workflow, Activities, Control Flow, various types of loops and decision making
Data Manipulation:
Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, File operation with step-by-step example, CSV/Excel to data table and vice versa

UNIT III
Taking Control of the Controls:
Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Handling events, revisit recorder, When to use OCR, Types of OCR available, How to use OCR
Plugins and Extensions:
Terminal Plugin, SAP Automation, Citrix automation and Credential management.

UNIT IV

Handling User Events and Assistant Bots:

Assistant bots, Monitoring system event triggers, Monitoring image and element triggers, Launching an assistant bot on a keyboard event

Exception Handling, Debugging, and Logging:

Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting

UNIT V

Managing and Maintaining the Code:

Project organization, nesting workflows, Reusability of workflows, Commenting techniques, State Machine, When to use Flowcharts, State Machines, or Sequences, Using config files

Deploying and Maintaining the Bot:

Publishing using publish utility, using Orchestration Server to control bots, deploy bots, License Management, Publishing and Managing updates

Text Book:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition

Reference Book:

1. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.

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COMPUTER SCIENCE AND ENGINEERING

Semester VII **L/T/P C**
3/0/0 3

QUANTUM COMPUTING (D57PE5B)

Course Objectives
To provide students with a comprehensive understanding of quantum computing principles and applications

Course Outcomes
Upon completion of this course the students will be able to :
1. Identify the significance of mathematics, physics, and biology in the development of quantum computing and compare Bits and Qubits, Classical Vs Quantum logical operations L3
2. Apply the basics of linear algebra, quantum mechanics, and the principles of genomics and proteomics to analyze quantum computing concepts L3
3. Design quantum circuits using Qubits, single and multiple qubit gates and Bell states. L3
4 Compare quantum and classical complexity classes and implement various quantum algorithms L4
5. Utilize quantum cryptography protocols for secure communication and apply quantum error correction techniques to mitigate noise and errors in quantum systems. L3

UNIT I
History of Quantum Computing:
Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT II
Background Mathematics:
Basics of Linear Algebra, Hilbert space, Probabilities and measurements.
Background Physics:
Paul's exclusion Principle, Superposition, Entanglement
and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT III
Qubit:
Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere
Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

UNIT IV
Quantum Algorithms:
Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

UNIT V

Noise and error correction:

Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

Text Book:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge

Reference Books:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol.I: Basic Concepts, Vol II
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

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Semester VII **L/T/P C**
3/0/0 3

REINFORCEMENT LEARNING (D57PE5C)

Course Objectives
To provide students with a comprehensive understanding of the principles of Reinforcement Learning (RL), policy-based reinforcement learning methods and meta-learning techniques for various applications.

Course Outcomes
Upon completion of this course the students will be able to :
1. Apply the principles and basics of Reinforcement Learning (RL), in various domains requiring data- driven decision-making and problem-solving. L3
2. Apply Reinforcement Learning theory, including Markov processes, Bellman equations, and optimality principles in designing and implementing effective RL algorithms for various applications. L3
3. Apply advanced reinforcement learning techniques, including dynamic programming, Temporal- Difference learning, and Deep Q-Networks to design and implement effective solutions for complex decision-making problems. L3
4. Analyze policy-based reinforcement learning methods Actor-Critic methods to design and deploy effective learning agents for a wide range of real-world tasks. L4
5. Apply principles of meta-learning, multi-agent reinforcement learning, policy-based methods, ethics to address real-world problems ethically and effectively. L3

UNIT I
Basics of Reinforcement Learning:
Overview of Machine Learning techniques, Introduction and basics of RL, Brush up of Probability concepts - axioms of probability, concepts of random variables, Probability Mass Function (PMF), Probability Density function (PDF), Cumulative Distribution Function (CDF),Expectation Concepts of joint and multiple random variables; joint, conditional and marginal distributions; correlation and independence.

UNIT II
Markov Decision Process:
Introduction to RL terminology, Markov property, Markov chain, Markov Reward Process (MRP), Introduction to Bellman equation, Introduction to Markov Decision Process (MDP), state-action value function, Bellman expectation equation, optimality of value functions and policies, Bellman optimality equation.

UNIT III
Tabular Methods and Q-Networks:
Planning through the use of dynamic programming and Monte Carlo method, Temporal- Difference learning methods (TD(0), SARSA, Q-Learning),Deep Q-Networks (DQN, DDQN, Dueling DQN, Prioritized Experience Replay).

UNIT IV

Policy Optimization:

Introduction to policy-based methods, Vanilla policy gradient, Actor-critic methods (A2C, A3C), Reinforce algorithm and stochastic policy search.

UNIT V

Recent Advances and Applications:

Meta-learning, Multi-Agent Reinforcement Learning (MARL), Introduction to Policy-Based Methods, Ethics in RL, Applying RL for real-world problems

Text Books:

1. Richard S. Sutton, Andrew G.Barto, Reinforcement Learning: An Introduction, 2nd Edition, MIT Press.
2. AbhishekNandy, ManishaBiswas, Reinforcement Learning,APress

Web reference:

1. https://www.tcsion.com/courses/industry-honour-course/reinforcement-learning

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COMPUTER SCIENCE AND ENGINEERING

Semester VII **L/T/P C**
3/0/0 3

MEDICAL IMAGE PROCESSING (D57PE5D)

Course Objectives:
To provide students with a comprehensive understanding of Medical Image Processing with the fundamental theories, techniques, and practical skills necessary for processing and analyzing medical images effectively.

Course Outcomes
Upon completion of this course the students will be able to :
1. Apply advanced digital image processing techniques, comprehend biomedical image characteristics, objectives, and challenges, fostering expertise in medical imaging analysis. L3
2. Make use of advanced image enhancement techniques, including contrast manipulation, histogram equalization, and various filters. L3
3. Analyze evaluate, and synthesize threshold and segmentation techniques, including detection methods, optimal threshold, multi-spectral threshold, edge-based segmentation, region- based segmentation, matching algorithms. L4
4. Analyze stochastic methods, Wiener filtering, and various registration approaches such as anatomy-based, object-based, and scene-based methods. L4
5. Analyze integrate advanced techniques in image reconstruction from projections, including Radon transform and various tomographic methods, L4

UNIT I
SPATIAL DOMAIN PROCESSING
Introduction, Steps in Digital Image Processing -Components –Elements of Visual Perception - Image Sensing and Acquisition - Image Sampling and Quantization -Relationships between pixels - color models- DICOM, Various modalities of Medical Imaging-CT, MRI, PET, Thermography, Angiography, CAD System, Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering. Simulation using MATLAB-Image sampling and quantization, Study of DICOM standards. Histogram Processing and Basic Thres holding functions, Image Enhancement-Spatial filtering.

UNIT II
FREQUENCY DOMAIN PROCESSING
Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters. Notch filter, Wavelets -Sub band coding-Multi resolution expansions Wavelets based image processing. Image Enhancement - Frequency domain filtering. Feature extraction using Wavelet Medical Image Processing, Spatial Domain Processing, Medical Image Restoration and Segmentation, Medical Image Representation and Recognition, Frequency Domain Processing, Medical Image Compression,
Boundary representation - Chain Code- Patterns and Pattern classes Lossless and Lossy Compression Image Restoration - Inverse Filtering – Wiener filtering. Detection of Discontinuities– Edge Linking and Boundary detection Ideal, Butterworth and Gaussian filters. Wavelets, Notch filter, Image Sampling and Quantization, Basics of Smoothing and Sharpening Spatial Filtering.

UNIT III

MEDICAL IMAGE RESTORATION AND SEGMENTATION

Image Restoration - Inverse Filtering – Wiener filtering. Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Region Growing, Region Splitting, Morphological processing- erosion and dilation, K Means and Fuzzy Clustering. Image segmentation – Edge detection, line detection and point detection. Region based Segmentation. Basic Morphological operations.

UNIT IV

MEDICAL IMAGE COMPRESSION

Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards -JPEG, JPEG2000.Image compression techniques.

UNIT V

MEDICAL IMAGE REPRESENTATION AND RECOGNITION

Boundary representation - Chain Code- Polygonal approximation, signature, boundary segments - Boundary description –Shape number -Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching, Content Based Image Retrieval. Analysis of Tissue Structure.

Text Book:

1. G.R. Sinha, Bhagwaticharanpatel, Medical Image Processing: Concepts and Applications,PHI Learning private limited.2014
2. Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing"Second Edition, CRC Press, 2005.
3. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.

References:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata McGraw Hill Pvt. Ltd., 2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. William K Pratt, “Digital Image Processing”, John Willey, 2002.
4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.
5. Geoff Dougherty, Medical Image Processing: Techniques and Applications, Springer Science & Business Media, 25-Jul-2011
6. Isaac N. Bankman, Handbook of Medical Image Processing and Analysis, Science Direct,2nd Edition, 2009.

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COMPUTER SCIENCE AND ENGINEERING

Semester VII **L/T/P C**
0/0/2 1

DEEP LEARNING LAB (D57PC24)

Course Objective:
To provide hands-on experience in developing and implementing deep learning models for classification tasks involving text, speech, video, and numbers .

Course Outcomes:
Upon completion of this course the students will be able to :
1. Develop programs to build DNN for text, speech, video and number classification. L3
2. Develop programs using CNN and its variants for the given tasks. L3
3. Build programs to develop auto encoders and generative adversarial networks for generating MNIST Handwritten Digits. L3

List of Experiments:
1. Build a deep neural network model start with linear regression using a single variable.
2. Build a deep neural network model start with linear regression using multiple variables.
3. Write a program to convert speech into text.
4. Write a program to convert text into speech.
5. Write a program to convert video into frames.
6. Write a program for Time-Series Forecasting with the LSTM Model.
7. Build a feed forward neural network for prediction of logic gates.
8. Write a program to implement deep learning Techniques for image segmentation.
9. Write a program for object detection using image labeling tools.
10. Write a program to predict a caption for a sample image using LSTM.
11. Write a program for character recognition using CNN.
12. Write a program to predict a caption for a sample image using CNN.
13. Write a program for character recognition using RNN and compare it with CNN.
14. Write a program to detect Dog image using YOLO Algorithm.
15. Write a program to develop Autoencoders using MNIST Handwritten Digits.
16. Write a program to develop a GAN for Generating MNIST Handwritten Digits.

Reference Books:
1. Navin Kumar Manaswi, Deep Learning with Applications Using Python Chatbots and Face, Object, and Speech Recognition WithTensorFlow and Keras, Apress, 2018.
2. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
3. Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition, 2017.

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COMPUTER SCIENCE AND ENGINEERING

Semester VIII **L/T/P C**
3/0/0 3

BLOCKCHAIN TECHNOLOGY (D58PC25)

Course Objectives:
To provide a comprehensive understanding of Blockchain and various types of block chain and mechanisms. public block chain system, Private block chain system and consortium blockchain.

Course Outcomes:
Upon completion of this course the students will be able to:
1. Make use of consensus mechanism to understand decentralization, distribution process and gain insights on blockchain protocols. L3
2. Implement smart contracts phenomenon to demonstrate public block chain system L3
3. Develop private, public and hybrid blockchain systems by analysing the ecommerce site as an example. L3
4. Apply the principle of security in blockchain phenomenon and analyze the security measures in the domains of banking and finance, education, health care, real-estate, Supply chain . L3
5. Analyze the concepts of block chain using case studies in Retail marketing, banking and financial services, health care and energy utilities. L4

UNIT I
Fundamentals of Blockchain:
Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future. Blockchain
Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. Cryptocurrency – Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT II
Public Blockchain System:
Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain. Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT III
Private Blockchain System:
Introduction, Key Characteristics of Private Blockchain, Need of Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E- commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State

Machine, Different Algorithms of Permissioned Blockchain, ByzantineFault, Multichain. Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda. Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT IV

Security in Blockchain:

Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric. Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real- estate, Blockchain In Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT V

Blockchain Case Studies:

Case Study 1 – Retail, Case Study 2 – Banking and Financial Services,Case Study 3 – Healthcare, Case Study 4 – Energy and Utilities. Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain. Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyper ledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Text Books:

1. "Blockchain Technology", Chandramouli Subramanian, Asha A. George, Abhilasj K A and Meena Karthikeyan, Universities Press.

Reference Books:

1. Michael Juntao Yuan, Building Blockchain Apps, Pearson, India.
2. Blockchain Blueprint for Economy, Melanie Swan, SPD O'reilly.
3. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gaur, Pearson.

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COMPUTER SCIENCE AND ENGINEERING

Semester VIII **L/T/P C**
3/0/0 3

WEB AND SOCIAL MEDIA ANALYTICS (D58PE6A)

Course Objectives:
To provide a comprehensive understanding of a variety of analytics tools and techniques, preparing them to tackle real-world challenges and enhance organizational decision-making processes.

Course Outcomes:
Upon completion of this course the students will be able to :,
1. Apply methods of business intelligence and analytics to interpret data for informed decision-making. L3
2. Apply text analytics and text mining concepts to analyze and interpret textual data, and implement a complete text mining process using various industry tools. L3
3. Apply sentiment analysis techniques to various data sources and implement sentiment analysis process to extract and interpret sentiments from textual and speech data. L3
4. Apply web analytics and web mining techniques to analyze and improve online presence and web analytics maturity model using various tools to deepen connections with users. L3
5. Apply social analytics and social network analysis techniques to interpret social media data and implement prescriptive analytics methods to support data-driven decision-making. L3

UNIT I
An Overview of Business Intelligence, Analytics, and Decision Support:
Analytics to Manage a Vaccine Supply Chain Effectively and Safely, Changing Business Environments and Computerized, Decision Support, Information Systems Support for Decision Making, The Concept of Decision Support Systems (DSS), Business Analytics Overview, Brief Introduction to Big Data Analytics.

UNIT II
Text Analytics and Text Mining:
Machine Versus Men on Jeopardy!: The Story of Watson, Text Analytics and Text Mining Concepts and Definitions, Natural Language Processing, Text Mining Applications, Text Mining Process, Text Mining Tools.

UNIT III
Sentiment Analysis:
Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process, Sentiment Analysis and Speech Analytics.

UNIT IV

Web Analytics, Web Mining:

Security First Insurance Deepens Connection with Policyholders, Web Mining Overview, Web Content and Web Structure Mining, Search Engines, Search Engine Optimization, Web Usage Mining (Web Analytics), Web Analytics Maturity Model and Web Analytics Tools.

UNIT V

Social Analytics and Social Network Analysis:

Social Analytics and Social Network Analysis, Social Media Definitions and Concepts, Social Media Analytics. Prescriptive Analytics- Optimization and Multi-Criteria Systems: Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking.

Text Book:

1. Ramesh Sharda, DursunDelen, Efraim Turban, Business Intelligence and Analytics: Systems for Decision Support, Pearson Education.

Reference Books:

1. Rajiv Sabherwal, Irma Becerra-Fernandez," Business Intelligence – Practice, Technologies And Management", John Wiley 2011.
2. Lariss T. Moss, ShakuAtre, "Business Intelligence Roadmap", Addison-Wesley It Service.
3. YuliVasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", SPD Shroff, 2012.

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COMPUTER SCIENCE & ENGINEERING

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VIDEO ANALYTICS – D58PE6B

Course Objectives:
To provide a comprehensive understanding of the models used for recognition of objects in videos.

Course Outcomes:
Upon completion of this course the students will be able to :
1. Apply the principles of multi-dimensional signal processing to solve problems related to signal manipulation, system analysis, and sampling. L3
2. Apply differential methods, matching methods, non-linear optimization methods, and transform domain methods to estimate motion in 2D images and 3D images. L3
3. Apply articulated human motion tracking techniques in low-dimensional latent spaces, considering factors such as occlusion and pose variation. L3
4. Utilize knowledge of behavioral analysis to develop algorithms for human activity recognition in various contexts. L3
5. Utilize knowledge of gait recognition techniques, including HMM frameworks and view-invariant approaches, to develop gait recognition systems. L3

UNIT I
Introduction: Multi-dimensional signals and systems:
signals, transforms, systems, sampling theorem. Digital Images and Video: human visual system and color, digital video, 3D video, digital-video applications, image and video quality.

UNIT II
Motion Estimation:
Image formation, motion models, 2D apparent motion estimation, differential methods, matching methods, non-linear optimization methods, transform domain methods, 3D motion and structure estimation.

UNIT III
Video Analytics:
Introduction- Video Basics - Fundamentals for Video Surveillance- Scene Artifacts- Object Detection and Tracking: Adaptive Background Modelling and Subtraction- Pedestrian Detection and Tracking Vehicle Detection and Tracking- Articulated Human Motion Tracking in Low-Dimensional Latent Spaces.

UNIT IV
Behavioral Analysis & Activity Recognition Event Modeling:
Behavioural Analysis- Human Activity Recognition-Complex Activity Recognition Activity modelling using 3D shape, Video summarization, shape-based activity models- Suspicious Activity Detection.

UNIT V

Human Face Recognition & Gait Analysis Introduction:

Overview of Recognition algorithms – Human Recognition using Face: Face Recognition from still images, Face Recognition from video, Evaluation of Face Recognition Technologies- Human Recognition using gait: HMM Framework for Gait Recognition, View Invariant Gait Recognition, Role of Shape and Dynamics in Gait Recognition

Text Books:

1. A. Murat Tekalp, "Digital Video Processing", second edition, Pearson, 2015
2. Rama Chellappa, Amit K. Roy-Chowdhury, Kevin Zhou. S, "Recognition of Humans and their Activities using Video", Morgan & Claypool Publishers, 2005.
3. Yunqian Ma, Gang Qian, "Intelligent Video Surveillance: Systems and Technology", CRC Press (Taylor and Francis Group), 2009.

Reference Books:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2011.
2. Yao Wang, Jorn Ostermann and Ya-Qin Zhang, "Video Processing and Communications", Prentice Hall, 2001.
3. Thierry Bouwmans, Fatih Porikli, Benjamin Höferlin and Antoine Vacavant, "Background Modeling and Foreground Detection for Video Surveillance: Traditional and Recent Approaches, Implementations, Benchmarking and Evaluation", CRC Press, Taylor and Francis Group, 2014.
4. Md. Atiqur Rahman Ahad, "Computer Vision and Action Recognition-A Guide for Image Processing and Computer Vision Community for Action Understanding", Atlantis Press, 2011.

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Natural Language Processing (D58PE6C)

Course Objectives:
To provide a comprehensive understanding of Natural Language Processing techniques and their relation to linguistics and statistics.

Course Outcomes:
Upon completion of this course the students will be able to:
1. Identify sensitivity to linguistic phenomena and an ability to model them with formal grammars. L3
2. Choose proper experimental methodology for training and evaluating empirical NLP systems. L3
3. Compare Manipulate probabilities, construct statistical models over strings and trees L4
4. Compare and contrast estimate parameters using supervised and unsupervised training methods. L4
5. Design, implement, and analyze NLP algorithms; and design different language modeling Techniques. L4

UNIT I
Finding the Structure of Words:
Words and Their Components, Issues and Challenges, Morphological Models Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches, Features

UNIT II
Syntax I: Parsing Natural Language, Treebanks:
A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms

UNIT III
Syntax II:
Models for Ambiguity Resolution in Parsing, Multilingual Issues
Semantic Parsing I: Introduction, Semantic Interpretation, System Paradigms, Word Sense

UNIT IV
Semantic Parsing II:
Predicate-Argument Structure, Meaning Representation Systems

UNIT V

Language Modelling:

Introduction, N-Gram Models, Language Model Evaluation, Bayesian parameter estimation, Language Model Adaptation, Language Models- class based, variable length, Bayesian topic based, Multilingual and Cross Lingual Language Modelling

Text Books:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and ImedZitouni, Pearson Publication.

Reference Book:

1. Speech and Natural Language Processing - Daniel Jurafsky& James H Martin, Pearson Publications.
2. Natural Language Processing and Information Retrieval: TanvierSiddiqui, U.S. Tiwary.

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CYBER FORENSICS (D58PE6D)

Course Objectives:
To provide a comprehensive understanding of knowledge to conduct digital forensic investigations effectively and ethically in various computing environments.

Course Outcomes:
Upon completion of this course the students will be able to :
1. Apply fundamental concepts of digital forensics to investigate and analyze digital evidence related to cyber incidents and outline the key steps involved in the incident response phase. L3
2. Identify the initial Response and Volatile Data Collection methods from Windows, Unix systems and to create forensic duplicates to preserve evidence integrity. L3
3. Identify the critical data to address the data hiding techniques and examine procedures for network forensics, using network tools. L3
4. Analyze computer forensic tools and techniques to evaluate forensic tool needs and perform acquisition and analysis procedures for cell phones and mobile devices in forensic investigations. L4
5. Apply knowledge of Windows and DOS systems to understand file systems, and demonstrate Microsoft and MS-DOS startup tasks, as well as the use of virtual machines. L3

UNIT I
Introduction of Cybercrime:
Types, The Internet spawns crime, Worms versus viruses, Computers' roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response, Phase after detection of an incident

UNIT II
Initial Response and forensic duplication, Initial Response & Volatile Data Collection from Windows system -Initial Response & Volatile Data Collection from Unix system – Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic. Duplicate/Qualified Forensic Duplicate of a Hard Drive

UNIT III
Forensics analysis and validation:
Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions. Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honey net project.

UNIT IV

Current Forensic tools:

evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools. Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT V

Working with Windows and DOS Systems:

understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

Text Books:

1. Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGraw Hill, 2006.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
3. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning

Reference Books:

1. Real Digital Forensics by Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison- Wesley Pearson Education
2. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition.