DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, MIT Manipal

M.Tech. COMPUTER SCIENCE AND ENGINEERING

Program Structure (Applicable to 2023 admission onwards)

YEAR	FIRST SEMESTER						SECOND SEMESTER					
	SUB CODE	SUBJECT NAME	L	T	P	C	SUB CODE	SUBJECT NAME	L	T	P	C
I	MAT ****	COMPUTATIONAL METHODS & STOCHASTIC PROCESSES	4	0	0	4	CSE ****	CLOUD INFRASTRUCTURE MANAGEMENT	3	1	0	4
	HUM ****	RESEARCH METHODOLOGY AND TECHNICAL COMMUNICATION	1	0	3	-	CSE ****	DEEP LEARNING AND APPLICATIONS	3	1	0	4
	CSE ****	ADVANCED DATA STRUCTURES AND ALGORITHMS	3	1	0	4	CSE ****	PROGRAM ELECTIVE I	4	0	0	4
	CSE ****	ADVANCED SYSTEMS SOFTWARE	4	0	0	4	CSE ****	PROGRAM ELECTIVE II	4	0	0	4
	CSE ****	QUANTUM COMPUTING	3	1	0	4	CSE ****	PROGRAM ELECTIVE III	4	0	0	4
	CSE ****	HIGH PERFORMANCE COMPUTING SYSTEMS	3	1	0	4	*** ****	OPEN ELECTIVE	3	0	0	3
	CSE ****	ADVANCED DATA STRUCTURES AND ALGORITHMS LAB	0	0	3	1	HUM ****	RESEARCH METHODOLOGY AND TECHNICAL COMMUNICATION	1	0	3	2
	CSE ****	ADVANCED SYSTEMS SOFTWARE LAB	0	0	3	1	CSE ****	CLOUD INFRASTRUCTURE MANAGEMENT LAB	0	0	3	1
	CSE ****	HIGH PERFORMANCE COMPUTING SYSTEMS LAB	0	0	3	1	CSE ****	DEEP LEARNING AND APPLICATIONS LAB	0	0	3	1
	Total		**18**	**3**	**12**	**23**			**22**	**2**	**9**	**27**
II	CSE ****	PROJECT WORK							**0**	**0**	**0**	**25**

PROGRAM ELECTIVES	
	PROGRAM ELECTIVE I
CSE ****	BLOCKCHAIN TECHNOLOGY AND APPLICATIONS
CSE ****	WIRELESS SENSOR NETWORKS
CSE ****	COMPUTER VISION & IMAGE PROCESSING
CSE ****	ADVANCED MACHINE LEARNING
	PROGRAM ELECTIVE II
CSE ****	MEDICAL IMAGE ANALYSIS
CSE ****	ARTIFICIAL INTELLIGENCE
CSE ****	IoT AND EDGE COMPUTING
CSE ****	FEDERATED LEARNING
	PROGRAM ELECTIVE III
CSE ****	NATURAL LANGUAGE PROCESSING
CSE ****	WEB TECHNOLOGIES AND APPLICATIONS
CSE ****	BIG DATA SYSTEMS AND ANALYSIS
CSE ****	SOFTWARE PROJECT MANAGEMENT

OPEN ELECTIVES	
CSE ****	APPLIED DATA SCIENCE
CSE ****	APPLIED NATURAL LANGUAGE PROCESSING
CSE ****	NETWORK SECURITY ESSENTIALS (Other than MTech ([CSIS])

SEMESTER I

MAT **** COMPUTATIONAL METHODS AND STOCHASTIC PROCESSES [4 0 0 4]

Optimization Techniques in Game Theory: Maximin-Minimax Principle, Graphical method, Dominance method, Optimization Techniques in Linear Programming: Mathematical modelling, Graphical method, Simplex method, Two-Phase method, Probability: Distributions, Covariance, Correlation, Sampling, Estimation in statistics, Testing of hypothesis, Bayesian Hypothesis, Stochastic Processes: Stationary process, Autocorrelation problems, Power density technique, Markov model, Classification of chains, Higher transition probabilities, Limiting behaviour, Linear Algebra: Orthonormal matrices, Gram Schmidt orthonormalization process, QR decomposition, SVD, Graph Theory: Walk, Connectedness, Minimum spanning trees, Connected components, Shortest Path method techniques, Advanced Numerical Methods: Boundary value problem, Finite difference method and Finite element method.

References:

1. G. Hadely, Linear Algebra, Addison-Wesley publishing company, Singapore (1961).
2. A. Papoulis & S. U. Pillai, Probability, Random Variables and Stochastic Processes, McGraw Hill (2002).
3. P. Z. Peebles Jr., Probability, Random Variables and Random Signal Principles, McGraw Hill International Edition, Singapore. (2001).
4. B. Carnahan, H. A. Luther, and J. O. Wilkes, Applied Numerical Methods, John Wiley & sons (1969).
5. H. A. Taha, Operational Research-An Introduction, Pearson Education, Edn 10 (2019).
6. F. Haray, Graph Theory, Narosa Publishing House (2001).
7. J. Medhi, Stochastic Processes, New Age International Publishers, Edn 3 (2009).

Course Outcomes:

After completing the course, the student will be able to:

1. Analyse optimization problems using game theory and simplex method.
2. Apply probability concepts in data analysis problems.
3. Analyse stochastic processes and Markov Chain Models.
4. Apply different decomposition techniques to eliminate the less important data in the matrix to produce a low-dimensional approximation.
5. Apply different techniques from graph theory in engineering problems.
6. Apply advanced numerical methods to engineering problems related to partial differential equations.

HUM **** RESEARCH METHODOLOGY AND TECHNICAL PRESENTATION [1 0 3 2]

Theory: Introduction, Types of research and Significance of research, The research process: The eight-step model. Reviewing the literature and summarizing the literature. Formulating a research problem: Identifying variables and hypotheses development. Research Design, Measurement scales, Data collection-primary and secondary sources of data, Establishing reliability and validity of research instrument. Sampling- types of sampling techniques, Ethical issues in data collection, processing data and displaying data. Writing a research proposal, Writing a research report, Presentation of figures and tables. Referencing-IEEE, APA and Harvard style of referencing. Making an effective technical presentation.

Lab exercises: The students are expected to conduct following tasks. Conduction of Literature review, Formulation of Research Problem through literature review, Developing conceptual framework and Hypothesis Development, Designing Research Methodology, Development of Research Instrument- Questionnaire, Development of Research Proposal, Presentations and evaluation.

References

1. Dr. Ranjit Kumar, Research Methodology: A step by step guide for beginners, SAGE, 4th edition. 2015.
2. Geoffery R. Marczyk, David DaMatteo & David Festinger, Essentials of Research Design and Methodology, John Wiley & Sons, 2004.
3. John W. Creswel, Research Design: Qualitative, Quantitative and Mixed Method Approaches, SAGE 2004.
4. Donald R Cooper & Pamela S Schindler, Business Research Methods, McGraw Hill International, 2007.
5. C. R. Kothari, Research Methodology: Methods and Techniques, New Age International Publisher, 2008.

Course Outcomes:

After completing the course, the student will be able to:

1. Define concept of research and recall types of research.
2. Define the problem and develop the research design to solve the problem
3. Organize a thesis report and a manuscript
4. Develop effective technical presentation
5. Develop a good research proposal

CSE XXXX: ADVANCED DATA STRUCTURES AND ALGORITHMS [3 1 0 4]

Amortized Analysis: Aggregate analysis, The Aggregate analysis, The accounting method, The potential method, Dynamic Tables. B-Trees: Basic operations on B-Trees, Deleting a key from a B-Tree. Binomial trees and Binomial heaps: Operations on Binomial heaps. Structure of Fibonacci heaps, Mergeable heap operations, Decreasing a key and deleting a node. The van Emde Boas Tree: Preliminary approaches, A recursive structure, Disjoint-set operations: Linked-list representation of disjoint sets, Disjoint set forests. Single-Source Shortest Path: The Bellman-Ford algorithm, Single-source shortest paths in directed acyclic graphs, Difference constraints and shortest paths. All-Pairs Shortest Paths: shortest Paths and matrix multiplication, Johnson’s algorithm for sparse graphs. Maximum Flow: Flow Networks, The Ford-Fulkerson method, Maximum Bipartite Matching, Multithreaded Algorithms: The basics of dynamic multithreading, Multithreaded matrix multiplication, Multithreaded merge sort. SDL: Probabilistic analysis and randomized algorithms, linear programming. Approximation algorithms

References:

1. Cormen Thomas H., Leiserson Charles E, Rivest Ronald L. and Stein Clifford, “Introduction to Algorithms”, (3e), MIT Press, 2009.
2. Cormen Thomas H., Leiserson Charles E, Rivest Ronald L. and Stein Clifford, “Introduction to Algorithms” (2e), Prentice-Hall India, 2001.
3. Baase Sara and Gelder A.V., “Computer Algorithms -Introduction to Design and Analysis”, (3e), Pearson Education, 2000
4. Anany Levitin, “Introduction to the Design and Analysis of Algorithms,” (3e), Pearson Education, 2011
5. Eli Upfal , Michael Mitzenmacher, " Probability and Computing: Randomization and Probabilistic Techniques in Algorithms and Data Analysis,2017
6. Ding-Zhu Du, Ker-I Ko, Xiaodong Hu, " Design and Analysis of Approximation Algorithms", Springer,2011

Course Outcomes

After completing the course, the student will be able to:

1. Make use of sequence of different types of data structure operations and their cost finding techniques
2. Demonstrate various advanced data structures such as B-tree, Binomial heaps, Fibonacci heaps
3. Utilize disjoint sets and van Emde Roas Tree.
4. Discover shortest paths for all pairs of vertices and from single source to all other vertices.
5. Understand the concept of maximum flow networks and to design and analyze Multi-Threading algorithms.

CSE XXXX: ADVANCED SYSTEM SOFTWARE [4 0 0 4]

Introduction, Memory Addressing, Processes, Kernel Synchronization, Process Scheduling, Memory Management, System Calls, The Virtual File System, Device driver introduction, Building and Running modules, Char Drivers, Debugging Techniques, Concurrency and Race Conditions, Allocating Memory, Communicating with Hardware, Data types in Kernel, Functional Programs: A short tour of Haskell, Compiling functional languages, Polymorphic type checking, Desugaring. Logic Programs: The logic-programming model, the general implementation model, interpreted, Unification. Parallel and Distributed Programs: Parallel programming models, Processes and threads, Shared variables, Message passing,
SDL: Parallel object-oriented languages, Automatic parallelization.

References:

1. Daniel P. Bovet and Marco Cesati, Understanding the LINUX KERNEL, (3e), O’Reilly Media, 2006.

2. Jonathan Corbet, Alessandro, Rubini, and Greg Kroah-Hartman, LINUX DEVICE DRIVERS, (3e) O'Reilly Media, 2005.
3. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs, Koen Langendoen, Modern Compiler Design, (2e), Springer Science+Business Media New York 2012

Course Outcomes:

At the end of the course, students must be able,

1. To comprehend Memory addressing, Processes, and Kernel Synchronization.
2. To comprehend Memory management, Processes scheduling, and system calls.
3. To analyse the implementation details of the drivers, and communication with hardware along with debugging Techniques.
4. To extract information from Function and Logic programs
5. To extract information from Parallel and Distributed Programs

CSE XXXX: QUANTUM COMPUTING [3 1 0 4]

Introduction to Quantum computation, Quantum bits, Single qubit operations, Postulates of quantum mechanics, Quantum Measurement, Bell states, EPR Paradox, No Cloning Theorem, Quantum Gates, Single qubit gates, Pauli Gates, Hadamard gate, Quantum Circuits, Multi-qubit gates, CNOT gate, Toffoli Gate, Fredkin Gate, Universal quantum gates, Quantum Key Distribution, Superdense coding and Quantum Teleportation, Quantum Parallelism and entanglement, The quantum Fourier transform (QFT), Walsh-Hadamard transformation, Quantum search algorithms, Grover's Search Algorithm, Deutsch Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Factorization algorithm, Quantum error correcting codes. Overview of Qiskit-IBM quantum computing open-source tool, SDL: Designing quantum circuits and implementing quantum algorithms using Qiskit.

References:

1. M. Nakahara and T Ohmi, "Quantum Computing From Linear algebra to Physical Realizations" CRC press 2008.
2. Michael A Nielsen, and Isaac L. Chuang "Quantum Computation & Quantum Information", (10e), Cambridge University Press, 2011.
3. Eleanor Rieffel and Wolfgang Polak, "Quantum Computing A Gentle Introduction", MIT Press, 2011.
4. Eric R. Johnston, Nic Harrigan & Mercedes Gimeno-Segovia, "Programming Quantum Computers", O'REILLY 2019.
5. F. Benatti, M. Fannes, R. Floreanini, and D. Petritis, "Quantum Information, Computation and Cryptography" Springer, 2010.
6. Mika Hirvensalo, "Quantum Computing", (2e), Springer-Verlag New York, 2004.
7. Jozef Gruska, "Quantum Computing", McGraw Hill, 1999.
8. Phillip Kaye, Raymond Laflamme and Michele Mosca, "An Introduction to Quantum Computing", Qxford University Press, 2006.

Course Outcomes:

After completing the course, the student will be able to:

1. Analyse quantum model of computation.
2. Design quantum algorithms.
3. Illustrate quantum protocols such as QKD, Quantum Teleportation and Super Dense Coding.
4. Implement quantum algorithms using Qiskit quantum computing open source tool.
5. Demonstrate various applications of quantum computing.

CSE XXXX: HIGH PERFORMANCE COMPUTING SYSTEMS [3 1 0 4]

Introduction to Parallel Computing, Need for Parallel Computing, Programmatic levels of parallel processing, Parallel Computer Structures, Handler’s classification, Feng’s classification, Applications of parallel processing, Synchronous Parallel Processing, Inter-PE Communications, Interconnection network, Parallel programming in OpenMP, OpenMP functions, Threads synchronization, OpenMP critical section, Message Passing Interface Programming, Message Passing Libraries, Point to point communication, Collective communication, MPI error handling, Heterogeneous Computing, OpenCL Architecture, Host/Device interaction, Kernels and OpenCL execution models, Program layout, Memory model, Thread structure, Work-item and work-group, Introduction to CUDA, CUDA programming model, CUDA threads, CUDA programming basics. SDL: Applications of parallel processing, Design of Interconnection network, OpenMP programming [1], [2]

References:

1. Kai Hwang, Faye A. Briggs, Computer Architecture and Parallel Processing, Tata McGraw-Hill India, 2012.
2. Michael J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw Hill, 2003.
3. Benedict R. Gaster, Lee Howes, David R, Perhaad Mistry, Dana Schaa, Heterogeneous Computing with OpenCL, Morgan Kaufmann, 2012.
4. David B. Kirk, Wen-mei W. Hwu, Pragramming Massively Parallel Processors,A Hands-on Approach, (2e),Elsevier, 2012.

Course Outcomes

After completing the course, the student will be able to:

1. Analyse the need of parallel computing with the structure of parallel computers.
2. Summarize the salient features of different multi core architectures to exploit parallelism using OpenMP.
3. Able to write MPI programs using point-to-point and collective communication primitives.
4. Design and implement parallel programs in modern environments using OpenCL.
5. Analyze and design parallel programs to enhance machine performance in parallel hardwar environment using CUDA.

CSE **** ADVANCED DATA STRUCTURES AND ALGORITHMS LAB [0 0 3 1]

Experiments based on theory covered in Advanced data structures. In the latter half of this lab, students will be working on more complex problems.

CSE **** HIGH PERFORMANCE COMPUTING SYSTEMS LAB [0 0 3 1]

This lab will provide a platform for students to learn various ways of parallel programming such as MPI and CUDA. It will enhance their understanding of parallel programming languages by working with the mini projects too.

Course Outcomes

After completing the course, the student will be able to:

1. Write MPI programs using point-to-point and collective communication primitives
2. Solve and test CUDA programs for parallel applications
3. Demonstrate the skill in parallel programming by developing mini projects

CSE **** ADVANCED SYSTEM SOFTWARE LAB [0 0 3 1]

Processes, Kernel Synchronization, Process Scheduling, System Calls, Device driver introduction, Building and Running modules, Char Drivers, Debugging Techniques, Concurrency and Race Conditions, Allocating Memory, Communicating with Hardware.

References:

1. Jonathan Corbet, Alessandro, Rubini, and Greg Kroah-Hartman, LINUX DEVICE DRIVERS, (3e), O'Reilly Media, 2005.
2. Robert Love, Linux System Programming, (2e), O'Reilly Media, 2013
3. David Clinton, Linux in Action, (1e), Manning Publications Co., 2018.

SEMESTER II

CSE XXXX: CLOUD INFRASTRUCTURE MANAGEMENT [3 1 0 4]

Cloud Computing, Adoption of cloud-based IT resources, Service Models, Deployment models, Cloud Computing Characteristics, Challenges of cloud computing, Virtualization concept, VM Migration, Hypervisor, Cloud Models, On-premises IT vs On-Cloud IT, Virtualization, Virtual Cluster Formation, Classic Data Centre (CDC), Virtualized Data Centre (VDC), Virtual Network devices, Cloud infrastructure vs. cloud architecture, Defining Cloud Infrastructure, Design issues of cloud-based development and deployment, Software Development Life Cycle, Data Centre Management Tools Integration, Service and Resource Management, Infrastructure Security and compliances ,Service-oriented architecture (SOA), Case Study: Cloud Infrastructure market analysis, Case Study: Security and Compliances. SDL: Design analysis of transition from WSN to IoT. IoT security.

References:

1. Lizhe Wang, Rajiv Ranjan, Jinjun Chen and Boualem Benatallah, Cloud Computing (1 ed.), CRC Press, 2017. ISBN 978-1351833097.
2. Judith S. Hurwitz and Daniel Kirsch, Cloud Computing For Dummies (1 ed.), Hoboken: John Wiley & Sons, 2020. ISBN 978-1119546658.
3. Chandra Rajasekharaiah, Cloud-Based Microservices: Techniques, Challenges, and Solutions (1 ed.), Apress, 2020. ISBN 9781484265642.
4. Prerna Sharma, Moolchand Sharma and Mohamed Elhoseny, Applications of Cloud Computing (1 ed.), missing, 2020. ISBN 9780367904128.Timoshenko S., Strength of materials, Vol. I & II, Princeton Co, 1988.
5. Silvano Gai, Building a Future-Proof Cloud Infrastructure (1 ed.), Addison-Wesley, 2020. ISBN 9780136624154
6. Eyal Estrin, Cloud Security Handbook (1 ed.), 2022

Course Outcomes:

After completing the course, the student will be able,

1. To articulate the building blocks of cloud infrastructure in the current industry scenario
2. To identify the design principles of virtualization techniques in cloud resource management
3. To design the cloud infrastructure using infrastructure as code.
4. To design and development of cloud architectural solution with its detailed monitoring.
5. To identify and analyze the cloud Infrastructure Security and compliances

CSE XXXX: DEEP LEARNING AND APPLICATIONS [3 1 0 4]

Introduction to Deep Learning & Architectures, Machine learning basics, Neural Networks basics, Feed Forward Neural Networks, Machine Learning Vs. Deep Learning, Representation Learning, Width Vs. Depth of Neural Networks. Activation Functions: Linear, Non-Linear, Sigmoid, Tanh, RELU, LRELU, ERELU, SoftMax. Regularization and Optimization for Deep Learning, Convolutional Neural Networks Architectural Overview, Layers, Filters, Parameter sharing, Regularization. Popular CNN Architectures: ResNet, AlexNet. Transfer Learning: Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet. Sequence Modelling: Recurrent and Recursive Nets, Recurrent Neural Networks, Bidirectional RNNs. Encoder-decoder sequence to sequence architectures, BPTT for training RNN, Long Short Term Memory Networks. Auto Encoders, Regularized Autoencoders , stochastic Encoders and Decoders, Contractive Encoders. Deep Generative Models, Deep Belief networks , Boltzmann Machines , Deep Boltzmann Machine , Generative Adversarial Networks. Recent Trends. SDL: Transformer models, Explainable AI, Multimodal deep learning.

Reference Books

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, “ Deep Learning”, MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
3. Umberto Michelucci “Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks” Apress, 2018.
4. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
5. Ethem Alpaydin,"Introduction to Machine Learning”, MIT Press, Prentice Hall of India, Third Edition 2014.
6. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
7. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017. 8. Francois Chollet "Deep Learning with Python", Manning Publications, 2017.
8. Rothman, Denis. Transformers for Natural Language Processing: Build innovative deep neural network architectures for NLP with Python, PyTorch, TensorFlow, BERT, RoBERTa, and more. Packt Publishing Ltd, 2021.
9. Samek, Wojciech, Grégoire Montavon, Andrea Vedaldi, Lars Kai Hansen, and Klaus-Robert Müller, eds. Explainable AI: interpreting, explaining and visualizing deep learning. Vol. 11700. Springer Nature, 2019.
10. Multimodal Deep Learning with Tensorflow, by Andrey But, Alexey Miasnikov, Gianluca Ortolani, Packt Publishing Limited, 2019.

Course Outcomes

At the end of the course, students must be able,

1. Differentiate the concept of machine learning with deep learning techniques for choosing suitable algorithms for different applications.
2. Understand the concept of CNN and transfer learning techniques to apply it in the classification problems.
3. Use RNN for time series prediction.
4. Use autoencoder and deep generative models to solve problems with high dimensional data including text, image, and speech.

5. Design and implement various machine learning algorithms in a range of real-world applications.

CSE **** DEEP LEARNING AND APPLICATIONS LAB [0 0 3 1]

Classification with Multilayer Perceptron using Scikit-learn (MNIST Dataset), Hyper-Parameter Tuning in Multilayer Perceptron , Deep learning Packages Basics: Tensorflow, Keras, Theano and PyTorch , Classification of MNIST Dataset using CNN , Parameter Tuning in CNN , Sentiment Analysis using CNN , Face recognition using CNN , Object detection using Transfer Learning of CNN architectures, Recommendation system using Deep Learning, Dimensionality Reduction using Deep learning, Time Series Prediction using RNN , Sentiment Analysis using LSTM, Image generation using GAN.

Reference Books

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.

Course Outcomes

After completing the course, the student will be able to:

1. Understand the parameter setting and classification for MNIST data set.
2. Design and develop recommendation system for digital marketing.
3. Design and develop emotion recognition system for measuring stress level.
4. Generate the synthetic data using GAN for better training.
5. Design and apply various CNN algorithms for image processing.

CSE XXXX CLOUD INFRASTRUCTURE MANAGEMENT LAB [0 0 3 1]

This lab will provide a platform for students to configure various virtualization tools such as Virtual Box and VMware workstation, Design and deploy web applications in PaaS environment, Install and use a generic cloud environment that can be used as private cloud, Manipulate large data sets in cloud environments.

CSE XXXX: BLOCKCHAIN TECHNOLOGY AND APPLICATIONS [4 0 0 4]

Introduction to Blockchain, Business Use Cases, Technology Use Cases, Legal and Governance Use Cases, Technology on Ethereum, Fast-Track Application Tutorial, Ethereum Application Best Practices, Private Blockchain Platforms and Use Cases, Challenges, Sample Application: Blockchain and Betting, Deploying the Sample Application: Blockchain and Betting, Opportunities and Challenges. Fundamental concepts and applications of Blockchain enabled fog and edge computing: Blockchain Internet of Things (B-IoT), Smart City, e-challan, Developing

Governance structure for Blockchain networks, Building a team to drive Blockchain Projects, Understanding Financial Models, Investment rubrics, and model risk frameworks, Blockchain in Logistics and examples across industries.
SDL: Looking ahead: What is a future world.

References:

1. Joseph J. Bambara Paul R. Allen, Blockchain A Practical Guide to Developing Business, Law, and Technology Solutions, McGraw-Hill Education, 2018
2. Dr. Muhammad Maaz Rehan and Dr. Mubashir Husain Rehmani. Blockchain-enabled Fog and Edge Computing Concepts, Architectures, and Applications, (1e) CRC Press, 2021
3. Jai Singh Arun, Jerry Cuomo, Nitin Gaur. Blockchain for Business, Pearson Education, Inc., 2019
4. Matthias Heutger, & Dr. Markus Kückelhaus. BLOCKCHAIN IN LOGISTICS, Accenture Digital, 2018

Course Outcomes:

1. To comprehend the basic concepts of blockchain technology and use cases.
2. To comprehend the Technology on Ethereum and Fast-Track Application implementation.
3. Ability to apply the concepts on fog and edge computing such as B-IoT, Smart city and e-challan
4. To analyse and deployment of Ethereum blockchain technology.
5. To extract information from Blockchain in Logistics and examples across industries

CSE XXXX: WIRELESS SENSOR NETWORKS [4 0 0 4]

Overview of Wireless Sensor Networks(WSN): Characteristics, Advantages, Challenges, Emerging Technologies, WSN Architectures: Hardware components, Operating systems and execution environment, Networking Sensors: Physical Layer and Transceiver Design Considerations, MAC Protocols for WSN, Routing protocols – Energy efficient Routing, Geographic Routing, Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control, Sensor Network Platforms and Tools: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, Case study: Emerging Applications and Future Research Directions.

References:

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, ―Wireless Sensor Networks Technology, Protocols, and Applications‖, John Wiley & Sons, 2015.
2. Feng Zhao & Leonidas J. G., "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007
3. Kazem Sohraby, Daniel Minoli, & TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007

4. C. S. Raghavendra, Krishna M. Shivalingam, Taieb Znati, "Wireless sensor networks", Springer Verlag.
5. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks; An Information Processing Approach", Elsevier

After completing the course, the student will be able to:

1. Outline principles and overview of Wireless Sensor Networks
2. Become aware of the various components involved in Wireless Sensor Networks architecture
3. Understand concepts of MAC, routing protocols and also study about the naming and addressing in WSN.
4. Analyze sensor node hardware and software platforms.
5. Apply concepts of Wireless Sensor Networks in a realistic scenario.

CSE XXXX: COMPUTER VISION& IMAGE PROCESSING [4 0 0 4]

Introduction to Computer Vision, Image formation, Image processing: Linear Filtering and Non-Linear Filtering, Image Transforms, Color Model, Feature detection and matching, Segmentation, Feature-based alignment, Camera models, Camera calibration, Stereo vision, Structure from motion, Motion estimation, Computational photography, Stereo correspondence, 3D-reconstruction, Image retrieval, Object Recognition. SDL: Segmentation: Graph cuts and energy-based methods, Image stitching, and Object recognition.

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer 2011.
2. David A. Forsyth and Jean Ponce, Computer Vision: A Modern Approach, PHI learning 2009.
3. Hartley, R. I. and Zisserman, A. Multiple View Geometry. Cambridge University Press, 2nd edition, 2004.
4. Bishop, C. M. Pattern Recognition and Machine Learning. Springer, 2006.

Course Outcomes:

At the end of this course, the student should be able to,

1. Demonstrate the concepts of image formation, colour models and linear filtering.
2. Identify the mathematics behind feature detection and description methods.
3. Understand the fundamental concepts in camera calibration.
4. Classify various object tracking algorithms.
5. Build object and scene recognition and categorization from images.

CSE XXXX: ADVANCED MACHINE LEARNING [4 0 0 4]

Introduction; Different Paradigms Of ML; Perspectives And Issues; Hypothesis Evaluation; VC-Dimensions and Distributions; Bias-Variance Trade-Off; Feature Selection (Filters and Wrapper Methods) and Dimensionality Reduction (PCA, LDA, ICA Etc.); Classification and RegressionTechniques;

Discriminative Methods;DistanceBased Methods; Linear Discriminant Functions; Decision Tree ;Attribute Selection; Tree-Pruning; Random Decision Forest and Boosting; Support Vector Machines;Linear and Non-Linear Kernel Functions; K- Nearest Neighbours; Clustering: K-Means Clustering; Gaussian Mixture Modeling; EM-Algorithm; Bayes Decision Theory; Bayesian Learning; Bayes Optimal Classifier;Naïve Bayes Classifier; Bayesian Belief Networks; Parameter Estimation: Maximum Likelihood and Bayesian Parameter Estimation; Artificial Neural Networks: Single Layer Neural Network; Multilayer Perceptron, Back Propagation Learning, Radial Basis Function Network; Gradient Descent Optimization; Recurrent Neural Networks; Deep Learning; Convolutional Neural Networks.

References:

1. Shalev-Shwartz,S., Ben-David,S., (2014), Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press
2. R. O. Duda, P. E. Hart, D. G. Stork (2000), Pattern Classification, Wiley-Blackwell, 2nd Edition.
3. Ethem Alpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition2014.
4. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press,2012.
5. Mitchell Tom (1997). Machine Learning, Tata McGraw-Hill
6. M. BISHOP (2006), Pattern Recognition and Machine Learning, Springer-Verlag New York, 1st Edition.

Course Outcomes

After completing the course, the student will be able to:

1. Illustrate principles and overview of learning problems domains and ML algorithms.
2. Utilize learning techniques like random-forest and ensemble method
3. Apply dimensionality reduction techniques for ML algorithm.
4. Make use of different ML algorithm like KNN, Naïve-Bayes and EM
5. Analyse ANN and RNN techniques for ML applications.

CSE XXXX: MEDICAL IMAGE ANALYSIS [4 0 0 4]

The Analysis of Medical Images, Digital Image Acquisition: X-Ray, MRI, US, Nuclear Imaging, Image Storage and Transfer, Image Enhancement: Measures of Image Quality, Image Enhancement Techniques, Noise Reduction, Feature Detection, Segmentation: Principles and Basic Techniques: Segmentation in Feature Space: Segmentation by Classification in Feature Space, Clustering in Feature Space, Active Contours and Active Surfaces: Explicit Active Contours and Surfaces, Level Sets, Geodesic Active Contours, Shape, Appearance and Spatial Relationships: Shape Models, Simple Models, Implicit Models, The Medial Axis Representation, Active Shape and Active Appearance Models, Validation: Measures of Quality, The Ground Truth., Representativeness of Data, Significance of Results, 3D volume creation and volume rendering techniques, Clinical applications of imaging case studies discussion. Medical image analysis software (ImageJ, MevisLab, 3Dslicer, pyRdiomics, ITKSnap, MITK).
SDL: Sampling, Quantization, Noise models, Color models [6]

References

1. Klaus D. Toennies. (2017). Guide to Medical Image Analysis Methods and Algorithms. Second Edition. Springer Germany.
2. Birkfellner and W, T. (2014). Applied Medical Image Processing: A Basic Course. 2nd Edition, Taylor and Francis
3. Nick Pears, Yonghuai Liu, Peter Bunting. (2012). 3D Imaging, Analysis and Applications, Springer Heidelberg, Springer London.
4. Bernhard Kainz, Kanwal Bhatia, Ghislain Vaillant, Maria A. Zuluaga. (2017). Reconstruction, Segmentation, and Analysis of Medical Images, Lecture Notes in Computer Science 10129, Springer
5. Marleen de Bruijne, Philippe C. Cattin, Stéphane Cotin, Nicolas Padoy, Stefanie Speidel, Yefeng Zheng, Caroline Essert (2021). Medical Image Computing and Computer Assisted Intervention – MICCAI 2021. LNCS 12901, Springer Germany
6. Rafael C. Gonzalez, Richard E. Woods (2017), Digital Image Processing, (4e), Pearson, 2017.

Course Outcomes:

Student should be able to,

1. Summarize the Imaging techniques, DICOM format and select the imaging technique for a clinical task
2. Apply and evaluate the image enhancement and segmentation methods to obtain objects of interest
3. Validate the segmented objects, analyze and measure the features.
4. Create the 3D volume and render the anatomical structures
5. Design and construct the methods to perform image processing using various tools

CSE XXXX: ARTIFICIAL INTELLIGENCE [4 0 0 4]

Intelligent Systems, Foundations of AI, Applications of AI, Current trends in AI, Characteristics of Problems, Problem reduction, Uninformed search strategies, Informed (Heuristic) search strategies, Heuristic functions, Game playing, Bounded look-ahead strategy and use of evaluation functions, Alpha-Beta Pruning, Two – Player perfect information games, Propositional Logic, Resolution Refutation in PL, Syntax and semantics of First order logic, using First order logic, Knowledge engineering in First order logic, Definition of classical planning, Block world problem, Algorithms for planning as state space search, Ontological Engineering, Categories and objects, reasoning systems for categories, Semantic Networks, Description logic, The internet shopping world, Forms of learning, Supervised learning, decision trees, Artificial neural networks, SDL: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, independence, Baye's Rule and its use, Representing knowledge in an uncertain domain, the semantics of Bayesian networks.

References:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence A Modern Approach", (3e), Pearson Education, 2010.
2. Elaine Rich, Kevin Knight, Shivashankar B Nair, "Artificial Intelligence", Tata McGraw Hill Edition, 2009.
3. Nils J. Nilsson, " Artificial Intelligence: a new synthesis", Morgan Kaufmann Publishers, 1998
4. Don W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI Publication, 2006.
5. Simon Haykin, "Neural Networks and Learning Machines",(3e), Pearson Education, 2008.
6. M. T. Hagan, H. B. Demuth, M. Beale, "Neural network design", Cengage Learning, India edition, 2010.

Course Outcomes:

1. Understand concepts of rational agents and represent real world problems.
2. Devise mechanisms to reach the goal state using searching techniques
3. Analyze hypothetical game trees, concepts of planning and knowledge representation
4. Infer the necessary axioms from the existing knowledge base in Propositional and Predicate logic.
5. Understand basics of uncertainty, expert systems and machine learning.

CSE **** IoT & EDGE COMPUTING [4 0 0 4]

IoT Fundamentals, Challenges and Issues, Physical Design, Logical Design, Functional Blocks, Security. IoT Architecture and Protocols. Communication modules: Bluetooth, Zigbee, Wifi, GPS. IoT Protocols (IPv6, 6LoWPAN, RPL, CoAP etc..), MQTT. Fog and Edge Computing Completing the Cloud, Hierarchy of Fog and Edge Computing, Business Models. Challenges in Federating Edge Resources: C2F2T. Optimization Problems in Fog and Edge Computing. Optimization Opportunities along the Fog Architecture. Middleware for Fog and Edge Computing. Applications and Issues: Exploiting Fog Computing in Health Monitoring, Smart Surveillance Video Stream Processing at the Edge for Real Time Human Objects Tracking, Fog Computing Model for Evolving Smart Transportation Applications. SDL: IoT architecture, protocols and cloud infrastructure needed for designing IoT product. Design IoT product for agricultural monitoring, health monitoring and smart campus using edge computing.

References:

1. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri. Internet of Things: Architectures, Protocols and Standards, 1 st edition, Wiley Publications, 2019.
2. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach, 1st edition, University press, 2014.
3. Buyya, Rajkumar, and Satish Narayana Srirama, eds, Fog and edge computing: principles and paradigms, 1st edition, John Wiley & Sons, 2019

Course Outcomes

At the end of the course, student is able to

1. Understand the fundamental of IoT and its protocols.
2. Understand the principles, architectures of edge and fog computing to address the problems in IoT architecture.
3. Understand storage and computation in edge and fogs to build cloud-less applications.
4. Design and Implement Internet of Everything (IoE) applications through edge and fog computing.
5. Analyze the performance of the applications developed using edge and fog.
6. Understand the security and privacy issues of edge & fog computing to establish secured environment for IoT applications using edge.

CSE XXXX: FEDERATED LEARNING [4 0 0 4]

Challenges in Big Data and Traditional AI; Understanding the current state of ML; Distributed learning nature – toward scalable AI; Understanding FL; FL system architecture; Basics of model aggregation; Scalability with horizontal design; The Design and Implementation of the Federated Learning System, Federated Learning Server Implementation; Federated Learning Client-Side Implementation; Local ML engine integration into an FL system; Model Aggregation; Secure Aggregation in Federated Learning; Understanding FedAvg; Modifying aggregation for non-ideal cases; Federated Learning Applications; Communication-Efficient Federated Learning-Compression Techniques in Federated Learning, Quantization Techniques in Federated Learning, Sparsification Techniques in Federated Learning;

References:

1. Kiyoshi Nakayama, George Jeno, Federated Learning with Python, Packt, 2022.
2. Heiko Ludwig, Federated Learning: A Comprehensive Overview of Methods and Applications, Springer 2022
3. Muhammad Habib ur Rehman, Federated Learning: Federated Learning Systems: Towards Next-Generation AI, Springer 2021
4. Qiang Yang, Federated Learning, Morgan & Claypool Publishers,2019

Course Outcomes

After completing the course, the student will be able to:

1. Illustrate the fundamental concepts and techniques of Federated Learning, including
2. its applications and differences from centralized.
3. Evaluate the advantages and disadvantages of different Federated Learning architectures, such as client-server, peer-to-peer, and hybrid.
4. Analyze and compare various distributed optimization algorithms used in Federated Learning.
5. Implement secure aggregation techniques in Federated Learning, including privacy preserving secure aggregation.
6. Apply communication-efficient techniques such as compression, quantization, and sparsification in Federated Learning.

CSE XXXX: NATURAL LANGUAGE PROCESSING [4 0 0 4]

Introduction to Natural Language Processing, Finite state morphological parsing, Finite state transducers for morphological parsing, FST Lexicon and rules, Minimum edit distance, N-Grams, Smoothing, Interpolation and Backoff, Part of speech tagging, Rule based and HMM based tagging, Using Viterbi algorithm for HMM tagging, Transformation based tagging, Formal grammars of English, Constituency, CFG, Grammar rules for English, Tree banks, Dependency Grammars, Syntactic parsing, Top-down, Bottom-up, Ambiguity, Dynamic Programming parsing, CKY algorithm, Statistical Parsing, Lexical semantics, Word senses, Computational lexical semantics, Word Sense Disambiguation, Naïve Bayes for text classification, Vector Semantics and Embeddings, Words and vectors, Cosine for measuring similarity, TF-IDF, Word2vec. SDL: Bag-of-Words, Scoring Words, Case-study

References:

1. Daniel Jurafsky & James H. Martin, "Speech and Language Processing", (2e), Pearson, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", (1e), O'Reilly Media, 2009.
3. Akshar Bharati, Rajeev Sangal and Vineet Chaitanya, "Natural Language Processing: A Paninian Perspective", Prentice-Hall of India, New Delhi, 1995.
4. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python – Analysing Text with natural language toolkit", O'Reilly Media, 2009.
5. Chris Manning, Hinrich Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, Cambridge, 1999.
6. Jason Brownlee, "Deep Learning for Natural Language Processing", Machine Learning Mastery, 2022.

Course Outcomes:

After completing the course, the student will be able to:

1. Describe the basic concepts and techniques of Natural Language Processing for analyzing words based on Morphology
2. Explain a variety of language modelling and smoothing techniques to develop knowledge for designing NLP based systems
3. Extract information from text using POS tagging of English language to select a suitable language modelling technique based on the structure of the language
4. Describe Context-Free Grammar and relate mathematical foundations, Probability theory with Linguistic essentials to perform syntactic and semantic analysis of text.
5. Describe representations of text using word embedding models in developing techniques for machine and deep learning models

CSE XXXX: WEB TECHNOLOGIES AND APPLICATIONS [4 0 0 4]

Web development with HTML, CSS, JavaScript, HTML5, Front end web UI frameworks, bootstrap, Bootstrap javascript components, Front end web development with react, react components with JSX, React router, react forms, flow architecture, Redux, Introduction to Redux overview of the Flux architecture, Server side development with NodeJS, Express and MongoDB, REST API using express, interact with MongoDB from a Node application, data storage with MongoDB, Mongoose ODM. SDL: Web Development with HTML, CSS, JavaScript: picture slideshows, and menu systems. Front-end Web UI Frameworks: Popovers, modals, and the carousel, Front-End Web Development with React: React Forms Server-side Development with NodeJS, Express and MongoDB: Mongoose ODM

References

1. Frank Zammetti, Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, APress publication, 2020.
2. Chris, The Full Stack Developer, APress publication, 2018.
3. Juha Hinkula, Hands-On Full Stack Development with Spring Boot 2 and React: Build modern and scalable full stack applications using Spring Framework 5 and React with Hooks, 2nd Edition, Packt publishing, 2019.
4. Nadar Dabit, Full Stack Serverless: Modern Application Development with React, AWS, and GraphQL Greyscale Indian Edition, 2020.

Course Outcomes:

At the end of the course students will be able to

1. Apply the knowledge of web development using HTML, CSS and Javascript to the real-world problem.
2. Apply the knowledge of front-end web UI framework for developing good UI framework for industry related problems.
3. Apply the knowledge of React for web related problems.
4. Apply the knowledge of development with NodeJS and Express for real world problems.
5. Apply the knowledge of MongoDB to design efficient and scalable data models in MongoDB.

CSE XXXX: BIGDATA SYSTEMS AND ANALYSIS[4 0 0 4]

Meaning of Big Data, Hadoop, Silos, Big Bang of Big Data, Parallel Processing for Problem Solving, Hadoop and HDFS, MapReduce Framework, Job Tracker and Task Tracker, YARN, Hadoop Ecosystem, Cloud-Based Hadoop Solutions, Spark and Data Stream Processing, Decision Making and Data Analysis in the Context of Big, Data Environment, Machine Learning Algorithms, Big Data Computing, Distributed Systems and Database Systems, Data Stream Systems and Stream Mining, Data Models, Data Products, Data Munging, Descriptive Analytics, Predictive Analytics, Data Science, Pig, Flume, Sqoop, Mahout, The Machine Learning Platform from Apache, GANGLIA, The Monitoring Tool, Kafka, The Stream Processing Platform, Spark, NoSQL Databases, Applications of Predictive Modelling. Case Studies

References:

1. C. S. R. Prabhu, Aneesh Sreevallabh Chivukula, Aditya Mogadala, Rohit Ghosh, L. M. Jenila Livingston. Big Data Analytics: Systems, Algorithms, Applications, Springer Nature. 2019.
2. Acharya S., Big Data and Analytics, Wiley India Pvt. Ltd., 2015
3. Holmes A., Hadoop in Practice, (2e), Manning Publications, 2015
4. Ryza S., Advanced Analytics with Spark: Patterns for Learning from Data at Scale, (2e), O'Reilly, 2017
5. White T., Hadoop: The definitve guide, (4e), O'Reilly, 2015

Course Outcomes:

At the end of course students must be able to,

1. Understand the Hadoop Ecosystem
2. Apply parallel processing for problem solving.
3. Apply machine learning algorithms on BigData.
4. Analyse the BigData.
5. Build the BigData systems.

CSE XXXX: SOFTWARE PROJECT MANAGEMENT [4 0 0 4]

Importance of Software Project Management, Management Principles, Strategic Program Management, Stepwise Project Planning. Project Schedules, Critical Path (CRM) Method, Risk Identification, Cost Schedules. Framework for Management and Control, Collection of Data Project Termination, Managing People, Organizational Behavior, Decision Making, Team Structures, Communication Plans, Case study. Need for Software Quality, Software Quality Assurance, Software Quality factors, Software Development methods, Quality Assurance Activities, Software Maintenance Quality, and Project Management. Staff Training and Certification Corrective and Preventive Actions, Project Process Control, Computerized Tools, Software Quality Metrics, Limitations of Software Metrics, Cost of Software Quality, Classical Quality Cost Model, Extended Model, Application of Cost Model. SDL: Risks in measuring software quality and domains of software quality.

References:

1. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management" (5e), Tata McGraw Hill, New Delhi, 2012.
2. Robert K. Wysocki, "Effective Software Project Management" (4e) – Wiley Publication, 2011.
3. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education (India), Fourteenth Reprint 2013.
4. Rajib Mall, "Fundamentals of Software Engineering" PHI Learning PVT. LTD, 4th Edition, 2014
5. Marcelo Marinho et.al; "A Systematic review of Uncertainties in Software Project Management", International Journal of Software Engineering & Applications (IJSEA), Vol.5, No.6, November 2014.
6. Daniel Galin, "Software Quality Assurance", ISBN 0201 70945 7, Pearson Publication, 2009.
7. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.

Course Outcomes:

After completing the course, the student will be able to:

1. Understand the basic tenets of Software Quality and its factors and be exposed to Software Quality Assurance (SQA) with its components.
2. Understand how the SQA components be integrated into the Software Project life cycle.
3. Be familiar with the Software Quality Infrastructure and staffing principles.
4. Utilize the concepts in Software Development Life Cycle and demonstrate their capability to adopt high quality standards.
5. Assess the quality of software product.

CSE XXXX: APPLIED DATA SCIENCE [3 0 0 3]

Python Basics, Understanding Python code, Importing modules, Python for statistics and probability: Types of data, importing and visualizing data, basic statistics, probability distributions, Modeling data, Monte Carlo Methods, Matplotlib: visualization charts and plots, covariance, correlation, Predictive Models: Regressions, Machine Learning with Python: Bayesian methods, Naïve classifier, K-Means Clustering, Entropy, Decision Trees, Ensemble Learning. SDL: Data dimensionality reduction techniques, Data Cleaning and normalization, K-Fold validation.

References:

1. Frank Kane, Hands-on Data Science and Python Machine-Learning, Packt Publication, 2017
2. Dirk P. Kroese, Zdravko Botev, Thomas Taimre, Radislav Vaisman, Data Science and Machine Learning: Mathematical and Statistical Methods, CRC Press, 2020
3. Bill Lubanovic, Introducing Python - Modern Computing in Simple Packages, O'Reilly Publication, 2015
4. Allen B. Downey, Think Python-How to think like a computer scientist, (2e) O'Reilly Publication, 2015

Course Outcomes:

After completing the course, the student will be able to:

1. Use Python to automate data analysis
2. Clean and verify the data to ensure it is accurate and uniform
3. Analyze and visualize data to gain insights from data.
4. Comprehend core concepts of machine learning algorithms for regression, clustering, and classification tasks.
5. Apply machine learning concepts to real-world problems using Python.

CSE XXXX: APPLIED NATURAL LANGUAGE PROCESSING [3 0 0 3]

NLP Overview, Word Tokenization, TF-IDF Vectors, Semantic Analysis, Language Processing and Python, Accessing text corpora and lexical resources, Processing Raw text, Foundation of Structured Programming, Doing More with Functions, Program Development, Algorithm Design, A Sample of Python Libraries, Categorization, and Tagging Words, Learning To Classify text, Reasoning with Word2Vec, Real World NLP Challenges – Information Extraction, Question Answering, Dialog Engines.

Self-Determined Learning(SDL) : Long Short Term Memory (LSTM) networks, Sequence to sequence models and attention (Reference available: Text Book 2)

References:

1. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, (1e), O'Reilly Media, 2009.
2. Natural Language Processing in Action, Hobson Lane, Cole Howard, Hannes Max Hapke, Manning, 2019.

Course Objective:

After completing the course, the student will be able to:

1. To comprehend python libraries for natural language processing
2. To use popular lexical resources and Python for NLP tasks
3. To extract information from unstructured text and develop methods for text classification
4. To analyze linguistic structures in text
5. To analyze Word2Vec and real-world NLP challenges

CSE ****: NETWORK SECURITY ESSENTIALS [3 0 0 3]

CIA triad, security attacks, mechanisms, services, model for network security, Symmetric encryption and message confidentiality, Public key encryption and message authentication, Key distribution and user authentication, Transport layer security SSL/TLS, HTTPS, Firewalls Types, implementation, Firewall Services and Limitations, Intrusion detection systems, types, challenges, implementation, intrusion prevention systems, IPSec: IPv4 and Ipv6, ESP, IKE phases, IPSec SA, Email Security PGP, S/MIME, Kerberos: Version 4, Realms, Interrealm authentication, Kerberos V5, Wireless network security-IEEE 802.11 and 802.15 security, Wireless Intrusion detection and prevention. Self-Directed Learning: Virtual Private networks, Security in sensor networks, Secure Electronic Transaction(SET)

References:

1. William Stallings, *Cryptography and Network Security – Principles and Practice*, (7e), Pearson, 2017.
2. Mark Rhodes Ousley, *The Complete Reference: Information Security*, (2e), Mc Graw Hill Publication, 2013.
3. Joseph Migga Kizza, *Guide to Computer Security*, (3e), Springer,2015.
4. William Stallings, *Network Security Essentials*, (4e), Prentice Hall, 2011
5. Charlie Kaufman, Radia Perlman, Mike Speciner, *Network Security : PRIVATE Communication in a PUBLIC World*, (2e), Pearson Education, 2005.

Course Outcomes:

After completing the course, the student will be able to:

1. Summarize the different symmetric and asymmetric ciphers
2. Analyse different authentication and key management and distribution mechanisms
3. Apply the knowledge of Firewalls and IDs to secure the networks
4. Describe the application of various cryptographic protocols in IP Sec and Email security
5. Demonstrate the concepts of Kerberos and wireless network security