DAYANANDA SAGAR UNIVERSITY

Shavige Malleshwara Hills, Kumaraswamy Layout,

Bengaluru - 560111, Karnataka.

SCHOOL OF ENGINEERING

SCHEME & SYLLABUS
FOR
MASTER OF TECHNOLOGY (M.Tech) – 2020

COMPUTER SCIENCE & ENGINEERING

(With Effect from 2020-21)

SEMESTER I

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	$\frac{CR}{AU}$	SCHEME OF TEACHING				
					L	T	P	S/P	C
1	202	20CSE5101	MATHEMATICAL FOUNDATIONS FOR EMERGING TECHNOLOGIES	CR	03	02	-	-	05
2	202	20CSE5102	CLEVER ALGORITHMS DESIGN	CR	03	-	04	-	05
3	202	20CSE5103	BIG DATA ANALYTICS	CR	03	-	04	-	05
4	202	20CSE5XXX	DEPARTMENT ELECTIVE – I	CR	03	-	02	-	04
5	202	20CSE5XXX	DEPARTMENT ELECTIVE – II	CR	03	-	02	-	04
6	202	20CSE5104	SPECIAL TOPICS-I	CR		-	-	02	01
					15	**02**	**12**	**02**	**24**

SEMESTER II

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	$\frac{CR}{AU}$	SCHEME OF TEACHING				
					L	T	P	S/P	C
1	202	20CSE5201	DATA MANAGEMENT	CR	03	-	04	-	05
2	202	20CSE5202	AGILE PROJECT MANAGEMENT & DEVOPS	CR	03	01	02	-	05
3	202	20CSE5203	ARTIFICIAL INTELLIGENCE: PRINCIPLES AND TECHNIQUES	CR	03	-	04	-	05
4	202	20CSE5XXX	DEPARTMENT ELECTIVE – III	CR	03	-	02	-	04
5	202	20CSE5XXX	DEPARTMENT ELECTIVE – IV	CR	03	-	02	-	04
6	202	20CSE5204	SPECIAL TOPICS-II	CR		-	-	02	01
					15	**01**	**14**	**02**	**24**

CR – CREDIT, AU – AUDIT, L – LECTURE, T – TUTORIAL, P – PRACTICAL, S/P – SEMINAR/PROJECT, C – NO. OF CREDITS,

SEMESTER III

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	$\frac{CR}{AU}$	SCHEME OF TEACHING				
					L	T	P	S/P	C
1	202	20CSE5XXX	DEPARTMENT ELECTIVE – V	CR	03	-	02	-	04
2	202	20CSE5301	DISSERTATION-I	CR	-	-	-	24	12
					03	-	**02**	**24**	**16**

SEMESTER IV

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	$\frac{CR}{AU}$	SCHEME OF TEACHING				
					L	T	P	S/P	C
1	202	20CSE5XXX	DEPARTMENT ELECTIVE – VI	CR	03	-	02	-	04
2	202	20CSE5401	DISSERTATION-II	CR	-	-	-	24	12
					03	-	**02**	**24**	**16**

Note: Dept. Elective V and VI will be conducted in flipped learning Mode

CR – CREDIT, AU – AUDIT, L – LECTURE, T – TUTORIAL, P – PRACTICAL, S/P – SEMINAR/PROJECT, C – NO. OF

DEPARTMENTAL ELECTIVES I / II / III / IV

SL	COURSE CODES	COURSE TITLE
1	20CSE5001	MACHINE LEARNING
2	20CSE5002	CLOUD COMPUTING & APPLICATIONS
3	20CSE5003	DEEP LEARNING-I
4	20CSE5004	DEEP LEARNING-II
5	20CSE5005	IOT AND NETWORK SECURITY
6	20CSE5006	KNOWLEDGE ENGINEERING AND EXPERT SYSTEMS
7	20CSE5007	PROBLEM SOLVING METHODS AND AUTOMATED REASONING
8	20CSE5008	DATA SCIENCE
9	20CSE5009	PATTERN RECOGNITION

DEPARTMENTAL ELECTIVES V / VI

SL	COURSE CODES	COURSE TITLE
1	20CSE5010	COMPUTER VISION
2	20CSE5011	MEDICAL IMAGE PROCESSING
3	20CSE5012	DIGITAL IMAGE PROCESSING
4	20CSE5013	BUSINESS INTELLIGENCE
5	20CSE5014	DATA ANALYTICS & VISUALIZATION
6	20CSE5015	INFORMATION RETRIEVAL TECHNIQUES
7	20CSE5016	ROBOTICS & AUTOMATION
8	20CSE5017	NATURAL LANGUAGE PROCESSING

MATHEMATICAL FOUNDATIONS FOR EMERGING TECHNOLOGIES

SEMESTER/YEAR : I/I
COURSE CODE : 20CSE5101
TITLE OF THE COURSE : MATHEMATICAL FOUNDATIONS FOR EMERGING TECHNOLOGIES
L: T/A: P: C : 3: 2: 0: 5

COURSE OBJECTIVES:

1. To gain knowledge of Mathematical foundations that are needed for Machine Learning/ IoT/Artificial Intelligence/Cloud Computing
2. To mathematically analyze different techniques in Machine Learning/ IoT/ ArtificialIntelligence/Cloud Computing domain

COURSE OUTCOMES:

At the end of the course students will be able to:

1. Analyze the mathematical concepts behind various Emerging Technologies and algorithms
2. Apply the knowledge to do mathematical analysis and proofs of various algorithms in the respectivedomain
3. Apply algorithm to avoid any pitfalls that occur due to shallow understanding of the mathematicalconcepts

MODULE 1 - Review of Machine Learning 09 hrs

Machine Learning Problem, Linear Regression, Generalization, Logistic Regression, k-Nearest Neighbors, k-Means, Revision of Variables, coefficients, and functions: logarithmic and exponential functions such as Sigmoid, trigonometric such as tanh, Softmax

MODULE 2 - Calculus and Optimization methods 09 hrs

Calculus: Concept of a derivative and partial derivative, Gradients, Gradient Descent Algorithm, Chainrule Optimization methods, Overflow and Underflow, Poor Conditioning, Gradient-Based Optimization, Constrained Optimization

MODULE 3 - Linear Algebra 10 hrs

Scalars, Vectors, Matrices and Tensors, Multiplying Matrices and Vectors, Identity and Inverse Matrices, Linear Dependence, Rank, Norms, Special Kinds of Matrices and Vectors, Eigen decomposition, Singular Value Decomposition, The Trace Operator, The Determinant, DimensionalityReduction

MODULE 4 - Probability and Information Theory 12 hrs

Random Variables, Probability, Distributions, Marginal Probability, Conditional Probability, The Chain Rule of Conditional Probabilities, Independence and Conditional Independence,

Expectation, Varianceand Covariance, Common Probability Distributions, Naïve Bayes', Bias and Variance tradeoff, Maximum Likelihood Estimation, Information Theory, Entropy, Mutual Information, Cross Entropy,Decision Trees

MODULE 5 - Trends In Emerging Technologies **10 hrs**

Mathematical analysis of latest research papers in machine Learning/Artificial Intelligence/IoT/CloudComputing

Text Books

1. Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, Dive into Deep Learning, Amazon Science, 2020
2. Deep Learning By Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press
3. Mathematics for Machine Learning. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng SoonOng., Cambridge University Press, 2020

Reference Books

1. Linear Algebra and Optimization for Machine Learning: A Textbook 1st ed. 2020 by Charu C.Aggarwal
2. Foundations of Machine Learning, Second Edition, Mehryar Mohri, Afshin Rostamizadeh, andAmeet Talwalkar, MIT Press, 2018
3. Computational Linear Algebra for Coders, Jeremy Howard and Rachel Thomas, fast.ai
4. https://github.com/fastai/numerical-linear-algebra/blob/master/README.md

CLEVER ALGORITHMS DESIGN

SEMESTER/YEAR	**: I/I**
COURSE CODE	**: 20CSE5102**
TITLE OF THE COURSE	**: CLEVER ALGORITHMS DESIGN**
L: T/A: P: C	**: 3:0:4:5**

COURSE OBJECTIVES

1. To understand the design of advanced algorithms and data Structures.
2. To understand the applications of algorithms in different fields such as AI, geometry, number theory, signal processing and linear algebra.
3. To get acquainted with various search and optimization algorithms.

COURSE OUTCOMES

1. Skill of advanced algorithm design.
2. Knowledge of advanced data structures
3. Knowledge of search and optimization algorithms

MODULE 1: **9 hrs**

INTRODUCTION: What is AI, Problem Domains, and Unconventional Optimization.

STOCHASTIC ALGORITHMS: Overview, Random Search, Stochastic Hill Climbing, Iterated Local Search, Guided local search, Scatter Search, Tabu Search.

MODULE 2: **9 hrs**

EVOLUTIONARY ALGORITHMS: Genetic Algorithm, Genetic Programming, Evolution Strategies, Differential Evolution, Evolutionary Programming, Grammatical Evolution

MODULE 3: **9 hrs**

PHYSICAL ALGORITHMS: Simulated Annealing, Harmony Search, Cultural Algorithm, Memetic Algorithm.

PROBABILISTIC ALGORITHMS: Population-Based Incremental Learning, Distribution Algorithm, Cross-Entropy Method

MODULE 4: **9 hrs**

SWARM ALGORITHMS: Particle Swarm Optimization, Ant System, Ant Colony System, Bees Algorithm

MODULE 5: **9 hrs**

ADVANCED TOPICS: Programming Paradigms, Devising New Algorithms, Testing Algorithms, Visualizing Algorithms, Problem Solving Strategies, Benchmarking Algorithms

Text Books:

1. Jason Brownlee, Clever Algorithms: Nature-Inspired Programming Recipes, Revision 2. 16th June2012

BIG DATA ANALYTICS

SEMESTER/YEAR : I/I
COURSE CODE : 20CSE5103
TITLE OF THE COURSE : BIG DATA ANALYTICS
L: T/A: P: C : 3: 0: 4: 5

COURSE OBJECTIVES

1. To optimize business decisions and create competitive advantage with Big Data analytics
2. To explore the fundamental concepts of big data analytics.
3. To learn to analyze the big data using intelligent techniques.
4. To understand the various search methods and visualization techniques.
5. To learn to use various techniques for mining data stream.
6. To understand the applications using Map Reduce Concepts.
7. To introduce programming tools PIG & HIVE in Hadoop echo system.

COURSE OUTCOMES:

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

1. Work with big data platform and explore the big data analytics techniquesbusiness applications.
2. Design efficient algorithms for mining the data from large volumes.
3. Analyze the HADOOP and Map Reduce technologies associated with big data analytics
4. Explore on Big Data applications Using Pig and Hive.
5. Understand the fundamentals of various big data analytics techniques.
6. Build a complete business data analytics solution

MODULE 1: 08 hrs

Introduction to big data : Introduction to Big Data Platform – Characteristics of big data- Data in the warehouse and data in Hadoop- Importance of Big data- Big data Use cases: Patterns for Big data deployment Challenges of Conventional Systems - Analytic Processes and Tools - Analysis vs Reporting.

MODULE 2: 09 hrs

Mining data streams: Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams –Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

MODULE 3: 10 hrs

Hadoop: History of Hadoop- the Hadoop Distributed File System – Components of

Hadoop Analysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Developing a Map ReduceApplication-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map ReduceFeatures Hadoop environment.

MODULE 4: **09 hrs**

Frameworks: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper -IBM InfoSphere Big Insights and Streams.

MODULE 5: **09 hrs**

Predictive Analytics- Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications

Text Books

1. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.

Reference Books

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.
4. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.
5. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
6. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 2 nd Edition, Elsevier, Reprinted 2008.

DEEP LEARNING-I

SEMESTER/YEAR : I/I
COURSE CODE : 20CSE5003
TITLE OF THE COURSE : DEEP LEARNING-I
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVES

1. To understand the basic building blocks and general principles that allows oneto design Deep learning algorithms
2. To become familiar with specific, widely used Deep learning networks
3. To introduce building blocks of Convolution neural network architecture
4. To learn to use deep learning tools and framework for solving real-life problems

COURSE OUTCOMES:

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

1. Build various deep learning models
2. Identify and Apply the deep learning algorithms which are more appropriate forvarious types of learning tasks in various domains
3. Implement deep learning algorithms and solve real-world problems deep learning tools and framework

MODULE-1 **7 Hrs**

Introduction to Machine learning - Types of Machine Learning problems, Linear Regression-Basic elements of linear regression, Vectorization for Speed, From Linear Regression to Deep Networks, Softmax Regression

MODULE-2 **5 Hrs**

Mathematical background for Deep learning- Data Manipulation and Data Preprocessing, Linear Algebra, Calculus, Probability

MODULE-3 **5 Hrs**

Multilayer Perceptrons-hidden layers, activation functions, Model Selection, underfitting, overfitting, weight decay, dropout

MODULE-4 **6 Hrs**

Forward Propagation, Backward Propagation, and Computational Graphs Layersand Blocks, shallow neural network, deep neural network, Optimization for training Deep Models.

MODULE-5 **5 Hrs**

Foundations of Convolutional Neural Networks- Convolution operation, Convolutional Layers, Object Edge Detection in Images, Padding and Stride, Multiple Input and Multiple

Output Channels, 1 × 1 Convolutional Layer, Pooling, Convolutional Neural Networks (LeNet)

Text Books

1. Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, “Dive into Deep Learning”, Amazon, 2020
2. François Chollet, “Deep Learning Python”, Manning Publications, 2018
3. Ethem Alpaydin, “Introduction to Machine Learning”, PHI, 2005
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, The MIT Press,2016.

Reference Books

1. Tom Mitchell, Machine Learning, McGraw-Hill, 1997
2. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow:Concepts, Tools, and Techniques to Build Intelligent Systems”, O'Reilly Media; 1 edition (April 9, 2017)
3. Josh Patterson, “Deep Learning: A Practitioner's Approach”, O'Reilly Media; 1st edition(August 19, 2017)

CLOUD COMPUTING AND APPLICATIONS

SEMESTER/YEAR	**: I/I**
COURSE CODE	**: 20CSE5002**
TITLE OF THE COURSE	**: CLOUD COMPUTING AND APPLICATIONS**
L: T/A:P: C	**: 3: 0:2:4**

COURSE OBJECTIVES:

1. To understand concepts of Cloud, Virtualization and limitations.
2. To understand cloud computing concepts, technologies and services.

COURSE OUTCOMES:

1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
2. Conceptual and sound knowledge of virtualization and different types of virtualization.
3. Acquire knowledge of cloud computing, technologies and services.
4. Explain the core issues of cloud computing such as security, privacy and interoperability.

MODULE 1 **08 hrs**

Introduction to Cloud Computing: Introduction- Historical Development – Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics –Cloud Deployment Models: Public, Private, Community, Hybrid Clouds- Cloud Delivery Models: IaaS, PaaS, SaaS – Open Source Private Cloud Software: Eucalyptus, Open Nebula, Open Stack.

MODULE 2: **09 hrs**

Virtualization: Definition, benefits, Data Center Technology – Virtualization – Characteristics of Virtualized Environments, Types of Virtualization, Para Virtualization, Hardware Assisted, Networking in virtualized environment, Virtual Machines and Access Control, Implementation Levels of Virtualization – Tools and Mechanisms: Xen, VMWare, Microsoft Hyper-V, KVM, Virtual Box

MODULE 3: **10 hrs**

Cloud Computing Mechanism: Cloud Infrastructure Mechanism: Cloud Storage, Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, Billing Management System.

MODULE 4: **09 hrs**

Security in the cloud: Basic Terms and Concepts – Threat Agents – Cloud Security Threats –Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images AWS, Google Compute Engine, Azure, BeanStack, Red Hat OpenShift

MODULE 5: **09 hrs**

Introduction to developing Cloud Services: Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – Microsoft Azure - IBM Clouds.

TEXT BOOKS

1. D. Marshall, W. A. Reynolds, and D. Mc Corry, Advanced Server Virtualization, Aurbech Publications, 2006.
2. John Rittinghouse& James Ransome, "Cloud Computing, Implementation,Management and Strategy", CRC Press, 2010.
3. Toby Velte, Anthony Velte, Robert C. Elsenpeter, "Cloud Computing, A Practical Approach",Tata McGraw-Hill Edition, 2010.
4. Dan C Marinescu-Cloud Computing Theory and Practice. Elsevier(MK) 2013.
5. RajkumarBuyya , James Broberg, AndrzejGoscinski- Cloud Computing Principles and Paradigms, Willey 2014.

AGILE PROJECT MANAGEMENT & DEVOPS

SEMESTER/YEAR	**: II/I**
COURSE CODE	**: 20CSE5202**
TITLE OF THE COURSE	**: AGILE PROJECT MANAGEMENT & DEVOPS**
L: T/A:P: C	**: 3:1:2:5**

COURSE OBJECTIVES:

The objectives of the course are to learn.

1. Agile methodology, Scrums, Sprints.
2. Agile testing, test automation, DevOps.
3. Agile Start-up, Design Thinking, Lean Startup.

COURSE OUTCOMES:

After undergoing this course, students will be able to

1. Be able to compare and contrast the differences between Agile and other project management methodologies
2. Be able to interpret and apply various principles, phases and activities of the Scrum methodology
3. Be able to understand Agile Testing principles for real life situations and learn the basics of SAFe for scaled agile
4. Be able to identify and use various tools for Agile development and DevOps principles for CI/CD
5. Enable start-up mindset through design thinking, lean startup and due-diligence

MODULE-1 **09 hrs**

Introduction to Agile. Introduction to Software engineering, SDLC, Software process models-waterfall, V model, Iterative model, Spiral model; Introduction to Agile: Agile versus traditional method comparisons and process tailoring; Introduction to Agile, Various Agile methodologies - Scrum, XP, Lean, and Kanban, Agile Manifesto, Scrum: Scrum process, roles - Product Owner, Scrum Master, Team, Release manager, Project Manager, product manager, architect, events, and artifacts; Product Inception: Product vision, stakeholders, initial backlog creation; Agile Requirements – User personas, story mapping, user stories, 3Cs, INVEST, acceptance criteria, sprints, requirements, product backlog and backlog grooming; Test First Development; Pair Programming and Code reviews; Tools: Agile tracking tools such as JIRA for defect tracking; Scaled agile frameworks: SAFe, Scrum@Scale, Disciplined Agile.

MODULE-2 **09 hrs**

Scrum and Sprint. Definition of Done, Definition of Ready; Estimation; Agile forecasting and project Management - Big visible information radiators, velocity, progress tracking, Track Done pattern, project forecasting, Ux Design, Control the Flow: Sprint Planning, Sprint Reviews, Sprint Retrospectives, Sprint Planning - Agile release and iteration (sprint) planning, Develop Epics and

Stories, Estimating Stories, Prioritizing Stories (WSJF technique from SAFe), Create product roadmap Sprints: Iterations/Sprints Overview. Velocity Determination, Iteration Planning Meeting, Iteration, Planning Guidelines, Development, Testing, Daily Stand-up Meetings, Progress Tracking, Velocity Tracking, Monitoring and Controlling: Burn down Charts, Inspect & Adapt (Fishbone Model), Agile Release Train.

MODULE-3 **09 hrs**

Introduction to Agile Testing. Testing: Functionality Testing, UI Testing, Performance Testing, Security Testing, A/B testing; Agile Testing: Principles of agile testers; The agile testing quadrants, Agile automation, Test automation pyramid; Test Automation Tools - Selenium, Appium, AI based testing; Unit testing of Kafka real-time streams; Traceability matrix

MODULE-4 **09 hrs**

DevOps. DevOps: Continuous Integration and Continuous Delivery; CI/CD: Jenkins, Git/Github Creating pipelines, Setting up runners Containers and container orchestration (Dockers and Kubernetes) for application development and deployment; Build tools - maven; Checking build status; Configuration management - puppet, chef, ansible; Fully Automated Deployment; CM - Continuous monitoring with Nagios; Introduction to DevOps on Cloud.

MODULE-5 **09 hrs**

Agile Start-up. Agile Start-up = Design thinking + Lean startup + Agile; Design thinking - Empathize, Define, Ideate, Prototype, Test; Lean Startup - Ideas, Build, Product, Empathize, Data, Learn; Due diligence - Reverse Engineering, Design thinking, Triz, Product Design and Development, Patenting, Start-up commercials, Funding aspects; Regulations - GDPR, Open source licensing.

Practice Exercises

1. Applying an Agile Mindset
2. Agile Estimation
3. Sprint Review, Retrospective and Execution
4. Scrum using Jira
5. Test Automation using Selenium
6. Test Automation using Appium
7. Unit Testing of Kafka Real-Time Streaming
8. CI/CD using Jenkins
9. Build a virtual start-up

Textbooks

1. Henrik Kniberg, Scrum and XP from the Trenches, 2nd Edition, 2015, Published by C4Media, publisher of InfoQ.com
2. Kenneth S. Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, 2012, published by Addison-Wesley Professional
3. Alistair Cockburn, Agile Software Development: The Cooperative Game, 2nd Edition, 2006, Addison-Wesley Professional

Reference Books

1. Agile Project Management: Creating Innovative Products, Second Edition By Jim Highsmith,

Addison-Wesley Professional, 2009
2. Agile Project Management: Managing for Success, By James A. Crowder, Shelli Friess, Springer 2014
3. Learning Agile: Understanding Scrum, XP, Lean, and Kanban, By Andrew Stellman, Jennifer Greene, 2015, O Reilly
4. DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive ... By Sricharan Vadapalli, Packt, 2018
5. Agile Testing: A Practical Guide For Testers And Agile Teams, Lisa Crispin, Janet Gregory, Pearson, 2010
6. More Agile Testing: Learning Journeys for the Whole Team By Janet Gregory, Lisa Crispin, Addison Wesley, 2015
7. DevOps: Puppet, Docker, and Kubernetes By Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu, Packt, 2017

ARTIFICIAL INTELLIGENCE: PRINCIPLES AND TECHNIQUES

SEMESTER/YEAR	**: II/I**
COURSE CODE	**: 20CSE5203**
TITLE OF THE COURSE	**: ARTIFICIAL INTELLIGENCE: PRINCIPLES AND TECHNIQUES**
L: T/A:P: C	**: 3:0:4:5**

COURSE OBJECTIVES:

1. To understand basic principles of Artificial Intelligence
2. To learn and design intelligent agents
3. To understand the basic areas of Artificial Intelligence including problem solving, knowledge representation, reasoning, decision making, planning, perception and action
4. To master the fundamentals of mathematical framework and learning algorithms

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Design Intelligent Agent for AI system
2. Apply the AI Principles and Implement AI based problem-solving techniques for solving real time problems

MODULE 1 **09 hrs**

Introduction – Definition –Foundations of Artificial Intelligence – Characteristics of Intelligent Agents –Typical Intelligent Agents – Structure Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

MODULE 2 **10 hrs**

AI Problems, AI Techniques and Types –The Level of the Model, Criteria for Success – Defining the Problem as a State Space Search –Problem Characteristics Un-Informed Search, Heuristic Search Techniques: Generate-And- Test, Hill Climbing – Constraint Satisfaction Problem– game trees – Adversarial Search: Minimax algorithm – Alpha beta pruning – Game playing.

MODULE 3 **09 hrs**

Logical Agent – Knowledge Representation – Propositional logic – First Order Predicate Logic– inferences in first order logic – forward chaining – backward chaining – Natural Deduction – Representing Knowledge using rules –Techniques – Matching Techniques.

MODULE 4 **09 hrs**

Quantifying Uncertainty – Probabilistic Reasoning - Probabilistic Reasoning over Time – Planning with state-space search – Partial-order planning – planning graphs – planning and acting in the real world – Learning from observation – Inductive learning – Decision trees – Explanation based learning – Statistical Learning methods - Reinforcement Learning.

MODULE 5 **10 hrs**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

Text Books

1. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition,2009.
2. Ivan Bratko, ―Prolog: Programming for Artificial Intelligence, Fourth edition, AddisonWesleyEducational Publishers Inc, 2011.
3. KishanMehrotra, "Elements of ANN", IIEdition, Pen ram International Publishing (I)Pvt. Ltd.Unit.
4. M.Tim Jones, ―Artificial Intelligence: A Systems Approach (Computer Science), Jones and BartlettPublishers, Inc.; 1 edition, 2008
5. Nils J. Nilsson, ―The Quest for Artificial Intelligence, Cambridge University Press, 2009.

DEEP LEARNING – II

SEMESTER/YEAR : II/I
COURSE CODE : 20CSE5004
TITLE OF THE COURSE : DEEP LEARNING-II
L: T/A:P: C : 3:0:2:4

COURSE OBJECTIVES

1. To understand the building blocks and working principles of advanced Deep learning models
2. To become familiar with few advanced topics in Deep learning

COURSE OUTCOMES

1. Identify and apply the learnt deep learning algorithms on specific tasks in various domains
2. Implement deep learning algorithms and solve real-world problems in various domains
3. To use learnt models for solving few real-life problems

MODULE 1 **09 Hrs**

Introduction to RNN: Basics of RNN, Rnns Computational Graph across Time, RNN's For Sequence Modeling- Language Modeling, Back Propagation Through Time, Standard RNN Gradient Flow, LSTM Network

MODULE 2 **08 Hrs**

Applications of RNN: Music Generation, Sentiment Classification, Machine Translation, Environment Modeling, Stock Market Prediction, Next Word Prediction

MODULE 3 **09 Hrs**

Deep Generative models: Generative Modelling, Autoencoders, Variational Autoencoders, Latent Perturbations, Image and Video Applications

MODULE 4 **09 Hrs**

GANs: Generative Adversarial Networks – Intuition behind Gans, Training Gans, Recent Advances In Gans

MODULE 5 **07 Hrs**

Success Stories and Limitations of using DL: Limitations and New Frontiers, Bias and Fairness, Taming Dataset Bias, Success Stories From Industry Domains

Text Books

1. Aston Zhang, Zachary C. Lipton, Mu Li, And Alexander J. Smola, “Dive Into Deep Learning”, April 2021
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, The MIT Press, 2016.

Reference Books

1. Palash Goyal Sumit Pandey Karan Jain, “Deep Learning For Natural Language Processing : Creating Neural Networks With Python”, Apress, 2018
2. Umberto Michelucci, “Applied Deep Learning A Case-Based Approach To Understanding Deep Neural Networks”, 2018
3. Aureilien Geron, Hands-On Machine Learning With Scikit-Learn & Tensorflow: Concepts, Tools, And Techniques To Build Intelligent Systems, O’Reilly, 2017
4. Josh Patterson, “Deep Learning: A Practitioner's Approach”, O'Reilly Media; 1 Edition (August 19, 2017)

MACHINE LEARNING

Semester/Year : II Sem / 1st Year
Course Code : 20CSE5001
Title of the Course : MACHINE LEARNING
L: T/A: P: C : 3 :0: 2 : 4

COURSE OBJECTIVES:
1. To know about basic concepts of Machine Learning
2. To obtain a thorough knowledge of various Machine learning techniques and their representation schemes
3. To study about Evaluating Hypothesis
4. To have an overview of various Machine Learning applications

COURSE OUTCOMES: At the end of the course students will be able to:
1. Technical knowhow of Machine Learning applications, heuristics, Knowledge representation Systems,
2. To Acquire knowledge of various Machine Learning techniques

Module 1: 6 hrs
Introduction: Basic definitions **Statistical Learning:** Estimate F, Supervised Versus Unsupervised Learning, Regression Versus Classification Problems **Accessing Model Accuracy:** Quality of fit, Bias –Variance trade-off, Classification Setting.

Module 2 6 hrs
Linear Regression: Simple Linear Regression, Multiple Linear Regression
Classification: Logistic Regression, Linear Discriminant Analysis: Baye's Theorem for classification, Quadratic Discriminant Analysis, KNN Method, Comparison of classification methods .

Module 3 6 hrs
Resampling Methods: Cross Validation: Leave-One-Out Cross-Validation, k-fold cross validation, Bootstrap.
Tree based methods: The Basics of Decision Tree: Regression tree method, Classification trees, Trees Versus Linear Models, Advantages and Disadvantages of Trees, Bagging ,Random forest, boosting.

Module 4 6 hrs
Support Vector Machines: Maximal Margin classifier, Support Vector classifier, Classification with non-linear decision boundaries, SVM with more than two classes.
Unsupervised Learning: Challenges, Principal component Analysis
Clustering –K-Means clustering, Hierarchical clustering.

Module 5 **6 hrs**

Deep Learning: Artificial Neural Networks: Universal Approximation Theorem, Feedforward Neural networks. Gradient descent and the Backpropagation Algorithm.
Convolutional Neural Networks : Architectures, convolution / pooling layers
Recurrent Neural Networks : LSTM, GRU, Encoder Decoder architectures
A Case Study -Computer Vision

Text Books

1. James, G., Witten, D., Hastie, T., Tibshirani, R. An Introduction to Statistical Learning with Applications in R, Springer Texts in Statistics.

Reference Books

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. (2015).
2. Thomas M. Mitchell, Machine Learning, McGraw-Hill, Inc. New York, ISBN:0070428077 9780070428072
3. EthemAlpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning series), The MIT Press; second edition, 2009

BUSINESS INTELLIGENCE

SEMESTER/YEAR : II/I
COURSE CODE : 20CSE5013
TITLE OF THE COURSE : BUSINESS INTELLIGENCE
L: T/A:P: C : 3:0:2:4

COURSE OBJECTIVES
1. To understand the fundamentals of Business Intelligence
2. To identify the appropriateness and need Analysis the data
3. To learn the preprocessing, mining and post processing of the data
4. To understand various methods, techniques and algorithms in Business Intelligence

COURSE OUTCOMES:
At the end of the course the students will be able to:
1. Apply basic, intermediate and advanced techniques to analysis the data
2. Analyze the output generated by the process of Business Intelligence
3. Explore the hidden patterns in the data
4. Optimize the mining process by choosing best Business Intelligence technique

MODULE 1 **09 Hrs**

Business Intelligence: Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

MODULE 2 **09 Hrs**

Knowledge Delivery: The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis. Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization

MODULE 3 **09 Hrs**

Decision Making Concepts Concepts of Decision Making, Techniques of Decision Support System (DSS), Types of Decision Support System (DSS), Development of Decision Support System (DSS), Applications of DSS, Role of Business Intelligence in DSS

MODULE 4 **09 Hrs**

Classification & Unsupervised Learning: Classification: Classification Problem, Classification Models, Classification Trees, Bayesian Method; Association Rule: Structure of

Association Rule, Apriori Algorithm, General Association; Clustering: Clustering Methods, Partition Methods, Hierarchical Methods.

MODULE 5 **09 Hrs**

Business Intelligence Applications: Data analytics, business analytics, ERP and Business Intelligence, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications

Text Books:

1. R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support,10th Edition. Pearson/Prentice Hall, 2015.ISBN-13: 978-0-13-305090-5, ISBN-10: 0-13-305090-4;
2. Business Process Automation, Sanjay Mohapatra, PHI.

References

1. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.
2. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager‟s Guide", Second Edition, 2012.
4. Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw-Hill, 2007.
5. Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, "The Data Warehouse Lifecycle Toolkit", Wiley Publication Inc.,2007.

CLOUD NETWORKING & SECURITY

SEM/YEAR : II/I
COURSE CODE : 20CIT5201
TITLE OF THE COURSE : CLOUD NETWORKING & SECURITY
L: T/A: P: C : 3: 0: 4: 5

COURSE OBJECTIVES

1. The course on cloud networking and security introduces the basic concepts of security systems and Google cloud networking.
2. Students learn about the broad variety of networking options on Google Cloud. This course uses lectures, demos, and hands-on labs to explore and deploy Google Cloud networking technologies, including Virtual Private Cloud (VPC) networks, subnets, and firewalls; interconnection among networks; load balancing; Cloud DNS; Cloud CDN; and Cloud NAT.
3. Students will also learn about common network design patterns and automated deployment using Cloud Deployment Manager or Terraform. It also discusses Cryptographic protocols, which are widely used in the design of cloud security.
4. The issues Related multi tenancy operation, virtualized infrastructure security and methods to improve Virtualization security are also dealt with in this course.

COURSE OUTCOMES:

After the course, the students must be able to:

1. Understand the Google cloud networking platform. Compare modern security concepts as they are applied to cloud computing
2. Assess the security of virtual systems
3. Evaluate the security issues related to multi-tenancy
4. Appraise compliance issues that arise from cloud computing

MODULE 1 **10 Hrs**

Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, Availability, access control, defense in depth, least privilege, how these concepts apply in the Cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. User Authentication in the cloud; Cryptographic Systems: Symmetric cryptography, stream Ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital Signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.

MODULE 2 **09 Hrs**

Multi-tenancy Issues: Isolation of users/VMs from each other. How the cloud provider can provide this; Virtualization System Security Issues: e.g. ESX and ESXi Security, ESX file

System security, storage considerations, backup and recovery; Virtualization System Vulnerabilities: Management console vulnerabilities, management server vulnerabilities, Administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, Hypervisor escape vulnerabilities, configuration issues, malware (botnets etc).

MODULE 3 **09 Hrs**

Networking options on Google Cloud. explore and deploy Google Cloud networking technologies, including Virtual Private Cloud (VPC) networks, subnets, firewalls; interconnection among networks; load balancing; Cloud DNS; Cloud CDN; and Cloud NAT. common network design patterns and automated deployment using Cloud Deployment Manager or Terraform.

MODULE 4 **09 Hrs**

Fundamentals of Virtual Private Cloud (VPC) networking in Google Cloud. Different types of VPC objects, Internal DNS, Cloud DNS, IP aliases and VMs with multiple network interfaces. ways to control access to VPC Networks, Cloud Identity and Access Management (Cloud IAM) and firewall rules.

MODULE 5 **09 Hrs**

Legal and Compliance Issues: Responsibility, ownership of data, right to penetration test. Local laws, examination of modern Security Standards (eg PCIDSS), Standards to deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.

Text Books

1. Tim Mather, Subra Kumaraswamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'ReillyMediaInc, 2009
2. Coursera "Google cloud security specialization " course.

Reference Books

1. Tim Mather, Subra Kumaraswamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance [ISBN: 0596802765]
2. Ronald L. Krutz, Russell Dean Vines, Cloud Security [ISBN: 0470589876]
3. John Rittinghouse, James Ransome, Cloud Computing [ISBN: 1439806802]
4. J.R. ("Vic") Winkler, Securing the Cloud [ISBN: 1597495921]
5. Cloud Security Alliance 2009, Security Guidance for Critical Areas of Focus in Cloud Computing
6. vmware VMware Security Hardening Guide
7. Cloud Security Alliance 2010, Top Threats to Cloud Computing
8. NIST Guidelines on Security and Privacy in Public Cloud Computing
9. NIST Guide to Security for Full Virtualization Technologies
10. NIST The NIST Definition of Cloud Computing
11. William Hau, Rudolph Araujo et al How Virtualization Affects PCI DSS www.mcafee.com/us/resources/.../wp-how-virt-affect-pci-dss-part-1.pdf
12. Chenxi Wang Compliance with Clouds: Caveat Emptor

SEMESTER	**II**
YEAR	**I**
COURSE CODE	**20CSE5201**
TITLE OF THE COURSE	**Data Management**

	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
SCHEME OF Instruction	**03**	**-**	**04**	**-**	**40**	**05**

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
1	II/I	20CSE5201	Data Management

COURSE OBJECTIVES:

- To understand advanced Data base concepts, query optimization
- To understand database concepts and structures and query language
- To understand the E R model and relational model
- To understand Data Warehouse, Data Mining, Relational Data Base Modelling, and Storage Management and Indexing
- To understand query processing and techniques involved in query optimization.
- To understand the principles of storage structure and recovery management.

COURSE OUTCOMES:

- Understand and apply the advanced concepts in Real time DBMS applications using structured query language and query optimization.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
- Analyze performance characteristics of RDBMS & Perform PL/SQL programming using concept of Cursor Management, Error Handling, Package and Triggers
- Apply various Normalization techniques to avoid data redundancy & apply the principles of storage structure and recovery management
- Implement various advance SQL queries related to Transaction Processing & Locking using concept of Concurrency control.

COURSE CONTENT:

MODULE 1 **08Hrs**

OVERVIEW OF DATABASE SYSTEMS: Managing Data, A Historical Perspective, File Systems versus a DBMS, Advantages of a DBMS, Describing and Storing Data in a DBMS INTRODUCTION TO DATABASE DESIGN: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Conceptual Design with the ER Model.

MODULE 2 **08Hrs**

RLEATIONAL DATABASE MODELING: An overview of data models, Basics of Relational Model, Defining a Relation Schema in SQL, An algebraic Query Language, Constraints on Relations, Functional Dependencies, Rules About Functional Dependencies, Design of Relational Database Schemas.

MODULE 3 **8Hrs**

SQL: QUERIES, CONSTRAINTS, TRIGGERS: Overview, The Form of a Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Databases, Introduction to NoSQL, Applications of NoSQL.

MODULE 4 **8Hrs**

STORING DATA: DISKS AND FILES: The Memory Hierarchy, Buffer Manager, Files of Records, Page Formats, Record Formats

SECURITY AND AUTHORIZATION: Introduction to Database Security, Access Control, Discretionary Access Control, Mandatory Access Control, Security for Internet Applications.

MODULE 5 **8Hrs**

STORAGE MANAGEMENT AND INDEXING: Physical Storage Systems: Storage Interfaces, Magnetic Discs, Flash Memory, RAID, Data Storage Structures: Database Storage Architecture, File Organization, Database Buffer, Storage Organization in Main Memory, Indexing.

List of Laboratory/Practical Experiments activities to be conducted:

1. Advanced SQL: Perform queries for DCL Commands and Locks, implement authorization, authentication, privileges on database, perform queries to Create synonyms, sequence and index, perform queries to Create, Alter and update views.

2. PL / SQL and Triggers: Implement PL/SQL programs using control structures, Implement PL/SQL programs using Cursors, Implement PL/SQL programs using exception handling, implement user defined procedures and functions using PL/SQL blocks, perform various operations on packages, Implement various triggers.

TEXT BOOKS :

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TMH, 3rd Edition, 2003.
2. Database Systems The complete Book, Hector Garcia-Molina Jeffrey D. Ullman Jennifer Widom, 2nd Edition, 2002.
3. Data base System Concepts, A. Silberschatz, H.F. Korth, S. Sudarshan, McGraw hill, VII edition, 2006.
4. Fundamentals of Database Systems 6th edition. Ramez Elmasri, Shamkant B.Navathe, Pearson Education, 2008.

DATA SCIENCE

SEM/YEAR : III/II
COURSE CODE : 20CSE5008
TITLE OF THE COURSE: DATA SCIENCE
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE:

1. To use the statistical and computational techniques to Discover, Analyze, Visualize andPresent the Data.

COURSE OUTCOMES:

At the end of the course the students will be able to:

1. To Summarize the data using visual & summary analytics and common probabilitydistributions
2. To make inference about a sample & population using hypothesis test.
3. To fit, interpret, and assess regression models and classification with one or morepredictors.
4. To assess the data integrity and data relevancy to a specific application

COURSE CONTENTS:

MODULE 1: INTRODUCTION 10 Hrs

Overview of the Data Science process. Different types of data, Data Preprocessing: Data Cleaning-Missing values, Noisy data, Data cleaning as process, Data Reduction: Principal Components Analysis, Data Transformation: Strategies Overview, Data Transformation by normalization, Discretization by binning. Introducing Python Libraries (Pycharm)

MODULE 2: EXPLORATORY DATA ANALYSIS AND HYPOTHESIS TESTING 09 Hrs

Exploratory Data Analysis: Central Tendency, Dispersions, Five number Distributions, CrossTabulations. Data Visualization: Histogram, Box Plot, Correlation Plot, Scatter Plot, Line Chart,Bar Chart, Pie Chart, Bubble Chart, Decision Tree, Cluster Charts.

Hypothesis Testing: Confidence Intervals, Constructing a hypothesis, Null Hypothesis & Alternative Hypothesis, Type I and Type II errors, Power Value

MODULE 3: PARAMETRIC AND NON-PARAMETRIC TESTS 07 Hrs

Parametric test: Z test, One Sample T-TEST, Paired T-TEST,Independent Sample T-TEST, ANOVA, MANOVA, Level of significance, Power of a test.

Non parametric test: Chi Square Test, Fisher's Test, Mann-Whitney U test, Kruskal-Wallis Rank Test, Wilcoxon sign rank.

MODULE 4: CLASSIFICATION MODELS **8 Hrs**

Classification Models: Logistic Regression, Discriminate Regression Analysis, Test of Associations, Chi-square strength of association, Maximum likelihood estimation, Confusion matrix, Support Vector Machines (SVM), Naive Bayes, Random Forests: Bagging & Boosting, CHAID Analysis, Decision trees, k-Nearest Neighbors, Neural Network.

MODULE 5: UNSUPERVISED LEARNING **7 Hrs**

Unsupervised Learning: Principle component analysis, Reliability Test, KMO tests, Eigen Value Interpretation, Rotation and Extraction steps. Clustering Methods: K Means clustering, Agglomerative Clustering

Text Books:

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and PresentingData, EMC Education Services,Wiley
2. Jiawei Han, Micheline Kember and Jian Pei, Data Mining Concepts and Techniques, 3rdedition, Elsevier, 2012
3. Statistics for Managers Using Microsoft Excel , 8th Edition, by David M. Levine , David F. Stephan , and Kathryn A. Szabat , Publisher: Pearson

References

1. Data Mining in excel: Lecture Notes and cases by Galit Shmueli, Publisher: Wiley
2. Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning" (2nd ed)., Springer,2008.

COMPUTER VISION

SEM/YEAR : IV/II
COURSE CODE : 20CSE5010
TITLE OF THE COURSE: COMPUTER VISION
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE:

1. To introduce various topics of computer vision with their applications.
2. Combining the analytics with CV which helps in various Video Analytics processing.

COURSE OUTCOMES:

1. Computer Vision along with video analysis helps the students to do the video analytics ina much easier way using Stereo Vision and Structure from motion features.
2. Students will be able to do analysis on various real time application of video analytics.

COURSE CONTENTS:

MODULE 1: IMAGE FORMATION AND CAMERA CALIBRATION 08 Hrs

Introduction to computer vision, geometric camera models, orthographic and perspective projections, weak- perspective projection, intrinsic and extrinsic camera parameters, linear andnonlinear approaches of camera calibration.

MODULE 2: IMAGE ANALYSIS-FEATURE DETECTION AND MATCHING 07 Hrs

Edge detection, interest points and corners, local image features for image analysis, featurematching and Hough transform, model fitting and RANSAC, scale invariant feature matching.

MODULE 3: VIDEO ANALYSIS-STEREO VISION 12 Hrs

Stereo camera geometry and epipolar constraints, essential and fundamental matrix, image rectification, local methods for stereo matching: correlation and multi-scale approaches, global methods for stereo matching: order constraints and dynamic programming, smoothness and graph
based energy minimization, optical flow

MODULE 4: ANALYSIS ON STRUCTURE FROM MOTION 08 Hrs

Camera self-calibration, Euclidean structure and motion from two images, Euclidean structure andmotion from multiple images, structure and motion from weak-perspective and multiple cameras.

MODULE 5: VIDEO ANALYTICS AND ITS APPLICATIONS 08 Hrs

Introduction to Video Analytics, Analysis Parameters-Real Time Security & User Insights, Storage analysis for Processed Video Data, Applications: Analysis on Facial Surveillance, License Plate Recognition, DWELL Analytics, Queue Line Analytics, People Counter Analytics-Analytics for shopper Data, Demographic Analytics. Case Study: Leveraging Video Analytics to Boost In-StorePerformance.

Text Books:

1. Forsyth, D. A. and Ponce, J., "Computer Vision: A Modern Approach", Prentice Hall, 2ndEd. 2011.
2. Szeliki, R., "Computer Vision: Algorithms and Applications", Springer, 2011.
3. Hartley, R. and Zisserman, A., "Multiple View Geometry in Computer Vision", CambridgeUniversity Press, 2003.
4. Gonzalez, R. C. and Woods, R. E., "Digital Image Processing", Prentice Hall, 3rdEd, 2009.
5. Trucco, E. and Verri, A., "Introductory Techniques for 3-D Computer Vision", PrenticeHall, 1998.
6. Website Link: http://www.3vr.com/