DAYANANDA SAGAR UNIVERSITY

Shavige Malleshwara Hills, Kumaraswamy Layout,

Bengaluru - 560111, Karnataka.

SCHOOL OF ENGINEERING

SCHEME & SYLLABUS
FOR
MASTER OF TECHNOLOGY (M.Tech)
COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

(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		20CSE5101	MATHEMATICAL FOUNDATIONS FOR EMERGING TECHNOLOGIES	CR	03	02	-	-	05
2		20CSE5102	CLEVER ALGORITHMS DESIGN	CR	03	-	04	-	05
3		20CSE5103	BIG DATA ANALYTICS	CR	03	-	04	-	05
4		20CIT5XXX	DEPARTMENT ELECTIVE – I	CR	03	-	02	-	04
5		20CIT5XXX	DEPARTMENT ELECTIVE – II	CR	03	-	02	-	04
6		20CIT5101	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		20CSE5201	DATA MANAGEMENT	CR	03	-	04	-	05
2		20CSE5202	AGILE PROJECT MANAGEMENT & DEVOPS	CR	03	01	02	-	05
3		20CIT5201	CLOUD NETWORKING & SECURITY	CR	03	-	04	-	05
4		20CIT5XXX	DEPARTMENT ELECTIVE – III	CR	03	-	02	-	04
5		20CIT5XXX	DEPARTMENT ELECTIVE – IV	CR	03	-	02	-	04
6		20CIT5203	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		20CIT5XXX	DEPARTMENT ELECTIVE – V	CR	03	-	02	-	04
2		20CIT5301	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		20CIT5XXX	DEPARTMENT ELECTIVE – VI	CR	03	-	02	-	04
2		20CIT5401	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. CREDITS,

DEPARTMENTAL ELECTIVES I / II / III / IV

SL	COURSE CODES	COURSE TITLE
1	20CSE5001	MACHINE LEARNING
2	20CSE5002	CLOUD COMPUTING AND APPLICATIONS
3	20CSE5003	DEEP LEARNING-I
4	20CSE5004	DEEP LEARNING-II
5	20CIT5001	DESIGN & DEVELOPMENT OF CLOUD WITH OPENSTACK
6	20CIT5002	DATA SCIENCE AND BIG DATA ANALYTICS
7	20CIT5003	CLOUD ARCHITECTURE

DEPARTMENTAL ELECTIVES V / VI

SL	COURSE CODES	COURSE TITLE
1	20CIT5004	CLOUD STORAGE INFRASTRUCTURES
2	20CIT5005	CLOUD VIRTUALIZATION
3	20CIT5006	CLOUD APPLICATION DEVELOPMENT
4	20CIT5007	BUSINESS INTELLIGENCE
5	20CIT5008	DATA ANALYTICS & VISUALIZATION

SEMESTER/YEAR : I SEM

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/ Artificial Intelligence/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 respective domain
3. Apply algorithm to avoid any pitfalls that occur due to shallow understanding of the mathematical concepts

MODULE 1 - **Review of Machine Learning** **9 hrs**

Machine Learning Problem, Linear Regression, Generalization, Logistic Regression, kNearest 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** **9 hrs**

Calculus: Concept of a derivative and partial derivative, Gradients, Gradient Descent Algorithm, Chain rule 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, Dimensionality Reduction

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, Variance and 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/Cloud Computing

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 Soon Ong., 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, and Ameet Talwalkar, MIT Press, 2018
3. Computational Linear Algebra for Coders, Jeremy Howard and Rachel Thomas, fast.ai https://github.com/fastai/numerical-linear-algebra/blob/master/README.md

SEMESTER/YEAR : I SEM
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 June 2012

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

COURSE OBJECTIVES

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

COURSE OUTCOMES:

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

- Work with big data platform and explore the big data analytics techniques

  business applications.

- Design efficient algorithms for mining the data from large volumes.
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics.
- Explore on Big Data applications Using Pig and Hive.
- Understand the fundamentals of various big data analytics techniques.
- Build a complete business data analytics solution

Module-1 8 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 9 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 Reduce Application-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 Reduce Features Hadoop environment.

Module-4 9 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 BigInsights and Streams.

Module-5 9 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.

SEMESTER/YEAR : I SEM

COURSE CODE : 20CSE5003

TITLE OF THE COURSE : DEEP LEARNING-I

L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVES

- To understand the basic building blocks and general principles that allows one to design Deep learning algorithms
- To become familiar with specific, widely used Deep learning networks
- To introduce building blocks of Convolution neural network architecture
- 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:

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

Module-1 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

7 Hrs

Module-2 Mathematical background for Deep learning- Data Manipulation and Data Preprocessing, Linear Algebra, Calculus, Probability **5 Hrs**

Module-3 Multilayer Perceptrons-hidden layers, activation functions, Model Selection, underfitting, overfitting, weight decay, dropout **5 Hrs**

Module 4: Forward Propagation, Backward Propagation, and Computational Graphs Layers and Blocks, shallow neural network, deep neural network, Optimization for training Deep Models.

6 Hrs

Module 5: 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) **5 Hrs**

Text Books

1. Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, "Dive into Deep Learning", Amazon Science, 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

5. Tom Mitchell, Machine Learning, McGraw-Hill, 1997
6. 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)
7. Josh Patterson, "Deep Learning: A Practitioner's Approach", O'Reilly Media; 1 edition (August 19, 2017)

SEMESTER/YEAR	**: I SEM**
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 **8 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: **9 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: **9 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: **9 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.