

**COURSE STRUCTURE (R19)
AND
DETAILED SYLLABUS
(IV YEAR)**

**COMPUTER SCIENCE &
SYSTEMS ENGINEERING**



LENDI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institution

Approved by AICTE & Permanently Affiliated to JNTUK, Kakinada
Accredited by NAAC with .A. Grade and NBA (CSE, ECE, EEE & ME)
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IV Year – I SEMESTER							
S.No	Course Code	Course Title	Category	L	T	P	Credits
1	R19CSS-PC4101	Cryptography and Network Security	PC	3	0	0	3
2	R19CSS-PC4102	Artificial Intelligence	PC	3	0	0	3
3	R19BSH-HM4101	Management Organizational Behavior	HM	3	0	0	3
4	R19CSS-OE4101	Open Elective -II (Inter Disciplinary) 1. Entrepreneurship & Incubation 2. Digital Image Processing 3. Optical Networks 4. NPTEL Course	OE	3	0	0	3
	R19ECE-OE4102						
	R19CSS-OE4103						
	R19CSS-OE4104						
5	R19CSS-PE4103.1	Professional Elective- III 1. Big Data Analytics 2. Social Media Analytics 3. Blockchain Technologies 4. NPTEL Course	PE	3	0	0	3
	R19CSS-PE4103.2						
	R19CSS-PE4103.3						
	R19CSS-PE4103.4						
6	R19CSS-PE4104.1	Professional Elective- IV 1. Data Science 2. Social Networks & Semantic Web 3. Principles of Cyber Security 4. UML & Design Patterns	PE	3	0	0	3
	R19CSS-PE4104.2						
	R19CSS-PE4104.3						
	R19CSS-PE4104.4						
7	R19CSS-PC4103	AI TOOLS & TECHNIQUES LAB	PC	0	0	3	1.5
8		Project-I	PR	0	0	8	4
Total				21	0	13	23.5

IV Year – II SEMESTER							
S.No	Course Code	Course Title	Category	L	T	P	Credits
1	R19CSS-PC4201	Machine Learning	HM	3	0	0	3
2	R19CSS-OE4203.1	Open Elective- III (Inter Disciplinary) 1. Virtual Reality 2. Green Energy Systems 3. Networking Analysis 4. NPTEL Course	OE	3	0	0	3
	R19ECE-OE4203.2						
	R19CSS-OE4203.3						
	R19CSS-OE4203.4						
3	R19CSS-PE4205.1	Professional Elective-V 1. Deep Learning 2. Natural Language Processing 3. Ad-hoc and Sensor Networks 4. NPTEL Course	PE	3	0	0	3
	R19CSS-PE4205.2						
	R19CSS-PE4205.3						
	R19CSS-PE4205.4						
3		Seminar		0	0	0	1
4		Project- II	PR	0	0	16	8
Total				9	0	16	18

Subject Code	Subject Name	L	T	P	C
R19CSS-PC4101	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

COURSE OBJECTIVES:

- In this course the following principles and practice of cryptography and network security are covered:
- Classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers)
- Public-key cryptography (RSA, discrete logarithms),
- Algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, key management, key exchange, signature schemes,
- Email and web security, viruses, firewalls, digital right management, and other topics.

COURSE OUTCOMES:

- Understand and analyse the importance of information security awareness.
- Understand the fundamentals of secret and public cryptography
- Implementation of protocols for security services
- Understand the network security threats and counter measures
- Understand and apply network security designs using available secure solutions (such as PGP, • SSL, IPSec, etc)

UNIT- I:

Basic Principles

Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography

Learning Outcomes: student will be able to

- Analyse security goals (L4)
- Understand various cryptographic attacks (L1)
- Understand and Apply some mathematical formulae for cryptography (L1, L3)

UNIT- II:

Symmetric Encryption

Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers,

Data Encryption Standard, Advanced Encryption Standard.

Learning Outcomes: student will be able to

- Understand Symmetric key Cryptography methods (L1)
- Understand fundamentals of symmetric cryptographic algorithms like DES, AES (L1)

UNIT- III:

Asymmetric Encryption

Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography

Learning Outcomes: student will be able to

- Understand the asymmetric cryptography algorithms like RSA, Elliptical Cryptography (L1)
- Understand protocols for security services (L1)

UNIT- IV:

Data Integrity, Digital Signature Schemes & Key Management: Message Integrity and Message Authentication, Cryptographic Hash Functions, DigitalSignature, Key Management.

Learning Outcomes: student will be able to

- Understand the Authentication functions, the way Message Authentication Codes and Hash Functions work. (L1)
- Understand the concepts of Digital Signature and Key Management (L1)

UNIT -V:

Network Security-I

Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS

Network Security-II

Security at the Network Layer: IPSec, System Security

Learning Outcomes: student will be able to

- Understand existing system security protocols like Kerberos, PGP, SSL, TLS and IPSEC

TEXTBOOKS:

- 1) Cryptography and Network Security, Behrouz A Forouzan, DebdeepMukhopadhyay, (3e)Mc Graw Hill.
- 2) Cryptography and Network Security, William Stallings, (6e) Pearson.
- 3) Everyday Cryptography, Keith M.Martin, Oxford.

REFERENCE BOOKS:

- 1) Network Security and Cryptography, Bernard Meneges, Cengage Learning.
- 2) Cryptography and Network Security: AtulKahate, Mc Graw Hill, 2nd Edition.
- 3) Information Security, Principles and Practice : Mark Stamp, Wiley India.
- 4) Principles of Computer Security: WM.Arthur Conklin, Greg White, TMH
- 5) Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
- 6) Principles of Information security by Michael E Whitman and Herbert J.Mattord.
- 7) Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1 st Edition

Subject Code	Subject Name	L	T	P	C
R19CSS-PC4102	Artificial Intelligence	3	0	0	3

COURSE OBJECTIVES:

- To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language
- To understand the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs
- To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning

COURSEOUTCOMES:

- Outline problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
- Apply the language/framework of different AI methods for a given problem
- Implement basic AI algorithms- standard search algorithms or dynamic programming
- Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports
- Design Expert Systems using fuzzy logic theory

UNIT- I:

Introduction: history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends.

Learning Outcomes: student will be able to

- Understand Intelligent systems
- Analyze the foundation of AI
- Understand tic-tac-toe gaming problem

UNIT -II:

Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening A*, constraint satisfaction.

Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.

Learning Outcomes: student will be able to

- Understand state-space search and control strategies
- Learns about heuristic search techniques
- Understand problem reduction and game playing

UNIT –III:

Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, resolution refutation in propositional logic, predicate logic.

Learning Outcomes: student will be able to

- Understand the Logic concepts like propositional calculus and logic
- Apply the techniques on some of the examples

UNIT -IV:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames.

Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, CYC theory, case grammars, semantic web

Learning Outcomes: student will be able to

- Understand about Knowledge Representation
- Learns about Advanced Knowledge Representation

UNIT-V:

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, Dempster-Shafer theory

Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

Learning Outcomes: student will be able to

- Understand Expert systems and its applications
- Apply Fuzzy sets and fuzzy logic on some problems

TEXT BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning
2. Artificial intelligence, A modern Approach, 2nded, Stuart Russel, Peter Norvig, PEA

REFERENCES:

1. Artificial Intelligence- Deepak Khemani, TMH, 2013
2. Introduction to Artificial Intelligence, Patterson, PHI
3. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Luger, 5thed, PEA

E-RESOURCES:

1. <https://nptel.ac.in/courses/106/105/106105077/>
2. <http://aima.cs.berkeley.edu/>

Subject Code	Subject Name	L	T	P	C
R19BSH-HM4101	Management Organizational Behaviour	3	0	0	3

COURSE OBJECTIVES:

- Provide fundamental knowledge on Management, Administration, Organization methodologies (L2)
- Equip with knowledge of Production, Materials, Inventory and Quality control (L3)
- Identify the conflict management skills related to Organization behavior (L3).
- Analyse the PERT/CPM techniques for better Project Management (L4)
- Comprehend the marketing mix for new product development (L2)

COURSE OUTCOMES:

- Apply concepts & principles of management & designs of organization in practical world. (L3)
- Apply principles of Work-study, Quality Control techniques and Inventory control in industry (L3)
- Develop PERT/CPM Charts for projects of enterprise and estimate time & cost of project. (L4)
- Realize concepts of individual behavior in organization. (L3)
- Ascertain functional management challenges with changes of levels in organization (L4)

Unit I:

INTRODUCTION TO MANAGEMENT: Management-Concept -Nature-Functions-Evolution of Management Thought-Motivational theories-Decision making Process-Leadership styles-Principles of Organization-Features and types of organizational structures.

Learning Outcomes:

At the end of this unit students will be able to:

- Acquire the techniques, skills and modern engineering tools necessary for engineering practice. (L3)
- Apply concepts & principles of management & structures of organization in a practical world (L3)
- Evaluate management aspects and its implementation in aim of achieving organizational goals (L5)

Applications:

Divide the class into two teams' old employees and new joiners and motivate the work environment with respect to excellent management and the supportive.

UNIT II:

OPERATIONS MANAGEMENT: Principles of operations management-Work Study-Statistical Quality Control: X-bar chart, R chart, C chart and P chart, (simple Problems) Inventory Management: Objectives, Inventory Controlling Techniques-EOQ-ABC Analysis.

Learning Outcomes:

At the end of this unit students will be able to:

- Equip with the concepts of operations & their technical relationships (L2)
- Utilization of techniques in Statistical Quality Control. (L3)
- Estimate qualitative and quantitative methods of inventory management. (L5)

Applications: Study the Inventory control employed in Big Bazaar and frame the basic inventory models which represent the inventory management.

UNIT III:

PROJECT MANAGEMENT: Project planning and control- Development of network- Difference between Program Evaluation Review Technique and Critical Path Method- Identifying critical path. (Simple problems).

Learning Outcomes:

At the end of this unit students will be able to

- Analyze methods of reducing the time and cost of the project. (L2)
- Visualize Project handling and control the techniques for optimum utilization of resources (L2)
- Develop PERT/CPM networks for projects of an enterprise and estimate time & cost of project (L4)

Application:

Estimation of the cost and time of the Highway Corridor of the Visakhapatnam Metro Tram Project.

UNIT IV:

INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR: Concept of Organizational Behaviour (OB)- Importance, Elements of organizational behaviour- Attitude, perception, learning- Social class- Organization culture, Characteristics of organizational culture, Cultural diversity- Conflict- Definition, Types.

Learning outcome

- Acquire the various challenges employee faces in an organization. (L2)
- Analyzed different rational decisions seen in the organization. (L3)
- Educate general history on management theory and practices. (L2)

Application:

Predict different approaches of cultural diversity and challenges seen in RINL and list out all the approaches to solve the problems.

UNIT V:

FUNCTIONAL MANAGEMENT: HRM- Definition- functions- Difference between Personnel Management and Human Resource Management- Job Evaluation and merit rating. Introduction of Marketing- Marketing mix- New product development- Product lifecycle.

Learning Outcomes:

At the end of this unit students will be able to:

- Understand the importance of human resources power in the main functional areas (L2)
- Study the latest methods involved in Human Resource Planning. (L3)
- Analyze the marketing concepts in the organizations (L4)

Applications:

Generate a self-study report of the variety of technical advancements and factors governing them in Wipro Technologies in Global level.

TEXTBOOKS

- Subba Rao P., *Organizational Behaviour*, Himalaya Publishing House, Mumbai
- Management Science by Aryasri; Publisher: Tata McGraw Hill, 2009
- L.M. Prasad, *Principles and Practice of Management*.

Reference Books:

1. Fred Luthans *Organizational Behaviour*, TMH, New Delhi.
2. Robins, Stephen P., *Fundamentals of Management*, Pearson, India.
3. Kotler Philip & Keller Kevin Lane: *Marketing Management* 12/e, PHI, 2007
4. Koontz & Weihrich: *Essentials of Management*, 6/e, TMH, 2007
5. Kanishka Bedi, *Production and Operations Management*, Oxford University Press, 2007.

Weblinks:

1. www.managementstudyguide.com
2. www.citehr.com
3. www.nptel.ac.in/courses/122106032
4. <https://nptel.ac.in/courses/110/106/110106145/>
5. www.btechguru.com/courses--nptel--basic-course

Subject Code	Subject Name	L	T	P	C
R19CSS-OE4101.1	Open Elective -II (Inter Disciplinary) Entrepreneurship & Incubation	3	0	0	3

Course Objectives:

- Creation of environment and facilities to instruct students and assist in identifying products or services.
- Develop innovative products, services, processes and techniques.
- Able to prepare financial proposals and start-ups.
- Promote the idea to collaborate with entrepreneurs skills in establishment of start-ups.
- Encourage the student to learn current trends of Science and Technology opportunities.

Course outcomes:

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- Enrich the knowledge of Entrepreneurial behavior, and skill development.
- Initiate business ideas that have value in the end-market.
- Identify the validity of idea and its unique selling proportion.
- Comprehend opportunity and challenges of start up (L2)
- Analyze various Government and non-Government financial resource.

Unit I: Fundamentals of Entrepreneurship

Entrepreneurship-Concept, Importance, Characteristics –Myths of Entrepreneurship -Role of Entrepreneurs in Indian economy –Social and Ethical Perspectives of Entrepreneurship.

Application: Case lets: Business cases of young entrepreneurs.

Learning Outcomes:

At the end of this unit students will be able to:

- Interpret the concepts of entrepreneurship and the characteristics of an entrepreneur. (L2)
- Explain the significance of entrepreneurship in the economic development of a nation. (L3)

Unit II: Ideation and Evaluation of Business Ideas

Opportunity identification – Ideations process - Sources of business ideas – Role of creativity –Sources of Innovation –Technological Innovation and Entrepreneurship - Product/ Service design –Design Thinking.

Case lets: Business cases of OYO.

Activity: Collection of novel business ideas.

Learning Outcomes:

- At the end of this unit students will be able to:
- Choose the right business ideas. (L3)
- Evaluate the business idea. (L2)

Unit III: Feasibility Analysis and Business plan

Thrust areas of entrepreneurship- Techno-economic feasibility assessment- Financial feasibility

Businesscanvas&Leancanvas.Activity:Preparationofbusiness plan(draft)

LearningOutcomes:

At theend ofthisunitstudentswillbeable to:

- Evaluatetechnicalfeasibility.(L1)
- DevelopLeancanvas. (L4)

UnitIV:BusinessIncubationandstartups

Fundamentalsofbusinessincubation-Servicesofincubators-Start-ups-meaning,significance-startupstrategy-Presentscenarioofstartups.

Activity: Analyzeandevaluateneuwestart-up..

LearningOutcomes:

At theend ofthisunitstudentswillbeable to:

- Describetheprocessofbusinessincubation/incubators(L2)
- Selectasuitableincubatorandbuilda feasiblebusinessmodel.(L3)

Unit V:Financialresources

Sourcesoffinance–Bootstrapping–GovernmentSupport–MSMEs - CrowdFunding– VentureCapitalists&AngelInvestors.

Activity:Businessplanfinalversion

LearningOutcomes:

At theend ofthisunitstudentswillbeable to:

- Knowledgeaboutvariousourcesoffinanceforentrepreneurship. (L2)
- AnalyzetheopportunitiesSeedcapital/Angelfinanciersandunderstandoperation.(L3)

Text Book:

1. T.VRao,DonaldF.Kuratko,Entrepreneurship, ASouth-AsianPerspective,CengageLearning,2012
2. DatsyDavies, IndianStartups,AmazonAsia-PacificHoldingsPrivateLimited,2016

ReferenceBooks:

1. P.N.Rath, SarjuePandita,Entrepreneurship:StartupIndia& StandupIndia,LexiconPublishingHouse,2018
2. MadhurimaLall, ShikhaSahai, Entrepreneurship,ExcelBooks(P)Ltd.2008
3. RajeevRoy,Entrepreneurship,OxfordHigherEducation.2011
4. H.Nandan,FundamentalsofEntrepreneurship,PHI Learning(P)Ltd,2013

WebResources:

<https://www.startupindia.gov.in/https://strategizer.com/canvas/business-model-canvashttps://canvanizer.com/new/lean-canvashttps://msme.gov.in/https://t->

<http://www.apinnovationsociety.com/index.phphttps://aim.gov.in/atal-incubation-centres.phphttps://nptel.ac.in/courses/110/106/110106141/>

Subject Code	Subject Name	L	T	P	C
R19ECE-OE4101.2	Open Elective -II (Inter Disciplinary) Digital Image Processing	3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of image processing and basic analytical methods to be used in image processing.
- To familiarize students with image enhancement and restoration techniques
- To explain different image compression techniques.
- To introduce segmentation and morphological processing techniques.

COURSE OUTCOMES:

- Understand the need for image transforms different types of image transforms and their Properties
- Develop any image processing application.
- Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.

UNIT- I:

Introduction :

Examples of fields that use digital image processing, fundamental steps in digital image processing, components of image processing system.. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, basic relationships between pixels.

Learning Outcomes:

Student will be able to

- Understand the Image Processing and Digital Image Processing and Pixels.

UNIT II:

Image enhancement in the spatial domain :

Basic gray-level transformation, histogram processing, enhancement using arithmetic and logic operators, basic spatial filtering, smoothing and sharpening spatial filters, combining the spatial enhancement methods.

Learning Outcomes:

Student will be able to

- Summarizing Image Enhancement in the Spatial Domain about Filters.

UNIT III:

Image restoration : A model of the image degradation/restoration process, noise models, restoration in the presence of noise—only spatial filtering, Weiner filtering, constrained least squares filtering, geometric transforms; Introduction to the Fourier transform and the frequency domain, estimating the degradation function.

Learning Outcomes:

Student will be able to

- Understanding the degradation and restoration process in Image Processing

UNIT IV:

Color Image Processing : Color fundamentals, color models, pseudo color image processing, basics of full-color image processing, color transforms, smoothing and sharpening, color segmentation.

Learning Outcomes:

Student will be able to

- Understanding the degradation and restoration process in Image Processing

UNIT V:

Image Compression : Fundamentals, image compression models, error-free compression, lossy predictive coding, image compression standards.

Image Segmentation : Detection of discontinuous, edge linking and boundary detection, thresholding, region-based segmentation.

Learning Outcomes:

Student will be able to

- Understanding the degradation and restoration process in Image Processing

TEXT BOOKS:

1. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, Second Edition, Pearson Education/PHI.

REFERENCE BOOKS:

1. Image Processing, Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac and Roger Boyle, Second Edition, Thomson Learning.

2. Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson

Course

Technology

3. Computer Vision and Image Processing, Adrian Low, Second Edition, B.S. Publications

4. Digital Image Processing using Matlab, Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins,

Pearson Education.

Subject Code	Subject Name	L	T	P	C
R19CSS-OE4101.3	Open Elective -II (Inter Disciplinary) Optical Networks	3	0	0	3

COURSE OBJECTIVES:

The main objectives of the course are to:

- Familiarize students with the optical network evolution, from the point-to-point link to the intelligent transport
- Introduce the main elements and components of the all-optical networking solution
- Explore the capabilities and limitations of the optical network
- Expose students to recent research articles on various optical networking issues

COURSE OUTCOMES:

After completion of the course students are expected to be able to:

- Identify the three generations of optical networking evolution, Name the all-important technological issues that affect how optical networks are implemented
- Comprehend the potentialities and limitations of optical networks
- Underline how these networks fit in the more classical communication networks based on electronic time division
- Compare the performance of optical networks via computer discrete-event simulation
- Review current optical networking trends like optical packet, burst or label switching from research articles

UNIT- I:

OPTICAL SYSTEM COMPONENTS:

Light propagation in optical fibers – Loss & bandwidth, System limitations, Non-Linear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

Learning Outcomes: student will be able to

- Understand Optical System Components, Optical Amplifiers, Switches and Wavelength Converters.

UNIT- II:

OPTICAL NETWORK ARCHITECTURES

Introduction to Optical Networks: SONET / SDH, Metropolitan-Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture.

Learning Outcomes: student will be able to

- Summarize about Optical Networks and Topologies for Broadcast Networks.

UNIT- III:

WAVELENGTH ROUTING NETWORKS

The optical layer, Node Designs, Optical layer cost tradeoff, Routing and wavelength assignment, Virtual topology design, Wavelength Routing Testbeds, Architectural variations.

Learning Outcomes: student will be able to

- Understand the Wavelength Routing Networks and Virtual Topology Design

UNIT- IV:

PACKET SWITCHING AND ACCESS NETWORKS

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronisation, Broadcast OTDM networks, Switch-based networks; Access Networks – Network Architecture overview, Future Access Networks, Optical Access Network Architectures; and OTDM networks.

UNIT V:

NETWORK DESIGN AND MANAGEMENT 9 Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations;

TEXT BOOK:

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks : A Practical Perspective”, Harcourt Asia Pte Ltd., Second Edition 2004.

REFERENCES: 1. C. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks : Concept, Design and Algorithms”, Prentice Hall of India, 1st Edition, 2002.

2. P.E. Green, Jr., “Fiber Optic Networks”, Prentice Hall, NJ, 1993.

Subject Code	Subject Name	L	T	P	C
R19CSS-PE4101.1	Professional Elective- III Big Data Analytics	3	0	0	3

COURSE OBJECTIVES:

- Optimize business decisions and create competitive advantage with Big Data analytics
- Introducing Java concepts required for developing map reduce programs
- Derive business benefit from unstructured data
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
- To introduce programming tools PIG & HIVE in Hadoop ecosystem.

COURSE OUTCOMES:

- Understands data summarization, query, and analysis.
- Applying data modelling techniques to large data sets
- Creating applications for Big Data analytics
- Creating a complete business data analytic solution

UNIT-I

Data structures in Java: Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization

Learning Outcomes: student will be able to

- Understands sets and maps
- Understands Generic classes and wrapper classes

UNIT-II

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Name node, Data node, Secondary Name node, Job Tracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

Learning Outcomes: student will be able to

- Understand HDFS and its basic building blocks
- Understand configuring Hadoop cluster and XML files

UNIT III

Hadoop I/O: The Writable Interface, Writable Comparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections, implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators

Learning Outcomes: student will be able to

- Understand and implement Hadoop I/O

UNIT IV

Writing MapReduce Programs: A Weather Dataset, Understanding Hadoop API for MapReduce Framework (Old and New), Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner

Learning Outcomes: student will be able to

- Understand Hadoop API for Map Reduce Framework
- Apply Map Reduce on applications

UNIT-V

Pig: Hadoop Programming Made Easier Admiring the Pig Architecture, going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and

Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin

Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients

Learning Outcomes: student will be able to

- Understand programming tools PIG & HIVE in Hadoop ecosystem.
- Creating a complete business data analytic solution

TEXT BOOKS:

- 1) Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC
- 2) Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
- 3) Hadoop in Action by Chuck Lam, MANNING Publ.
- 4) Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk, Bruce Brown, Rafael Coss

REFERENCE BOOKS:

- 1) Hadoop in Practice by Alex Holmes, MANNING Publ.
- 2) Hadoop MapReduce Cookbook, SrinathPerera, ThilinaGunarathne

SOFTWARE LINKS:

- 1) Hadoop: <http://hadoop.apache.org/>
- 2) Hive: <https://cwiki.apache.org/confluence/display/Hive/Home>
- 3) Piglatin: <http://pig.apache.org/docs/r0.7.0/tutorial.html>

Subject Code	Subject Name	L	T	P	C
R19CSS-PE4101.2	Professional Elective- III Social Media Analytics	3	0	0	3

Course Objectives:

By the end of this course, students will be able to:

1. Understand and apply key concepts in social media metrics.
2. Understand and apply social media analytics tools.
3. Collect social media data and Monitor consumers and competitors and glean deeper consumer insights based on advanced social media data modeling.
4. Develop social media strategy and measure social media campaign effectiveness.
5. Make better business decisions by leveraging social media data.

Course Outcomes:

1. Familiarize the learners with the concept of social media analytics
2. Understand its Significance of Social Media Analytics
3. Familiarize the learners with the tools of social media analytics.
4. Enable the learners to develop skills required for analyzing the effectiveness of social media for business purposes.

Unit-I

Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas
Network Fundamentals and Models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods.

Learning Outcomes:

At the end of this module student will be able to:

- Summarize the Social Media and studying about Network Fundamentals. (L2)

Unit-II

Making Connections: Link analysis, Random graphs and network evolution. **Social contexts:** Affiliation and identity.

Web Analytics Tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing, Natural Language Processing Techniques for Micro-text Analysis

Learning Outcomes:

At the end of this module student will be able to:

- Analyzing Social Media by using Different tools (L4)

Unit-III

Facebook Analytics: Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube, Twitter etc.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Demographics on Social Media (L2)

Unit-IV

Google Analytics: Introduction. (Websites) Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Analytics by using Visualizing on Social Media (L2)

Unit-V

Applications in Advertising and Game Analytics Introduction to Python Programming, Collecting and analyzing social media data, visualization and exploration.

Practical: Students should analyze the social media of any ongoing campaigns and present the findings.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Collecting Data and analyzing Social Media Data (L2)

TextBooks:

1. Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Matthew Ganis, Avinash Kohirkar, Pearson-2016 edition.
2. Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Jim Sterne, Wiley publisher, Latest edition.

Reference Books:

1. Social Media ROI: Managing and Measuring Social Media Efforts in Your Organization (Que BizTech), Oliver Blanchard, Que Publishing, Latest edition.
2. Social Media Analytics, Marshall Sponder, McGraw Hill, Latest edition.
3. Social Media Marketing, Tracy L. Tuten, Michael R. Solomon, Sage, Latest edition.

Subject Code	Subject Name	L	T	P	C
R19CSS-PE4101.3	Professional Elective- III Blockchain Technologies	3	0	0	3

Course Objectives:

By the end of the course, students will be able to

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interactwith them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from block chain technology into their own projects.

Course Outcomes:

At the end of the course, student will be able to

- Demonstrate the foundation of the Block chain technology and understand the processes in paymentand funding.
- Identify the risks involved in building Block chain applications.
- Review of legal implications using smart contracts.
- Choose the present landscape of Blockchain implementations and Understand Crypto currency Markets
- Examine how to profit from trading crypto currencies.

UNIT I

Introduction, Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities

Using Blockchain, History of Blockchain. Evolution of Blockchain : Evolution of ComputerApplications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution,Consortia, Forks, Public Blockchain Environments, Type of Players in Blockchain Ecosystem, Players in Market.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Blockchain Evolution (L2)

UNIT II

Blockchain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Miningand Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain,wallets,coding on blockchain: smart contracts, peer-to-peer network, types of blockchain nodes, riskassociated with blockchain solutions, life cycle of blockchain transaction.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Blockchain Concepts and Currency/wallets and coding (L2)

UNIT III

Architecting Blockchain solutions: Introduction, Obstacles for Use of Blockchain, BlockchainRelevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications.

Learning Outcomes:

At the end of this module student will be able to:

- Summarize about Architecting Blockchain Solutions (L2)

UNIT IV

Ethereum Blockchain Implementation: Introduction, Tuna Fish Tracking Use Case, EthereumEcosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract
Programming, Integrated Development Environment

Learning Outcomes:

At the end of this module student will be able to:

- Summarize and understanding about Blockchain Implementation using Case study (L2)

UNIT V

Hyperledger Blockchain Implementation, Introduction, Use Case – Car Ownership Tracking,Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking
Chaincode Functions Using Client Application Advanced Concepts in Blockchain.

Learning Outcomes:

At the end of this module student will be able to:

- Summarize and understanding about Blockchain Implementation using Case study (L2)

Text Books:

- 1) Ambadas, Arshad SarfarzAriff, Sham “Blockchain for Enterprise Application Developers”, Wiley
- 2) Andreas M. Antonopoulos, “Mastering Bitcoin: Programming the Open Blockchain” , O’Reilly

Reference Books:

- 1) Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
- 2) Blockchain: Blueprint for a New Economy, Melanie Swan, O’Reilly

Subject Code	Subject Name	L	T	P	C
R19CSS-PE4102.1	Professional Elective- IV Data Science	3	0	0	3

COURSE OBJECTIVES:

From the course the student will learn

- Provide you with the knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
- Learn to statistically analyze a dataset;
- Explain the significance of exploratory data analysis (EDA) in data science.
- Critically evaluate data visualizations based on their design and use for communicating stories from data

Course Outcomes:

At the end of the course, student will be able to

- Describe what Data Science is and the skill sets needed to be a data scientist.
- Apply basic tools (plots, graphs, summary statistics) to carry out EDA.
- Describe the Data Science Process and how its components interact.
- Use APIs and other tools to scrap the Web and collect data.
- Apply EDA and the Data Science process in a case study.

UNIT I

Introduction, The Ascendance of Data, Motivating Hypothetical: Data Science, Finding Key Connectors, The Zen of Python, Getting Python, Virtual Environments, Whitespace Formatting, Modules, Functions, Strings, Exceptions, Lists, Tuples, Dictionaries defaultdict, Counters, Sets, Control Flow, Truthiness, Sorting, List Comprehensions, Automated Testing and assert, Object-Oriented Programming, Iterables and Generators, Randomness, Regular Expressions, Functional Programming, zip and Argument Unpacking, args and kwargs, Type Annotations, How to Write Type Annotations.

Learning Outcomes:

At the end of this module student will be able to:

- Understand about Data Science and get knowledge on Data Science with Python (L2)

UNIT II

Visualizing Data: matplotlib, Bar Charts, Line Charts, Scatterplots. Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation.

Learning Outcomes:

At the end of this module student will be able to:

- Understand about Visualizing Data using Bar Charts, line charts etc... (L2)

UNIT III

Getting Data: stdin and stdout, Reading Files, Scraping the Web, Using APIs, Working with Data: Exploring Your Data Using Named Tuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.

Learning Outcomes:

At the end of this module student will be able to:

- Working with API's and Exploring data by using different python modules (L2)

UNIT IV

Machine Learning: Modeling, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, k-Nearest Neighbors, Naive Bayes, Simple Linear Regression, Multiple Regression, Digression, Logistic Regression.

Learning Outcomes:

At the end of this module student will be able to:

- Summarizing how Data Science and Machine Learning working in applications (L2)

UNIT V

Support Vector Machines, Decision Trees, Neural Networks: Perceptrons, Feed-Forward Neural Networks, Backpropagation. Clustering: The Idea, The Model, Choosing k, Bottom-Up Hierarchical Clustering.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Support Vector Machines. (L2)

Textbooks:

- 1) Joel Grus, “Data Science From Scratch”, OReilly.
- 2) Allen B. Downey, “Think Stats”, OReilly.

Reference Books:

- 1) Doing Data Science: Straight Talk From The Frontline, 1st Edition, Cathy O’Neil and Rachel Schutt, O’Reilly, 2013
- 2) Mining of Massive Datasets, 2nd Edition, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge University Press, 2014
- 3) “The Art of Data Science”, 1st Edition, Roger D. Peng and Elizabeth matsui, Lean Publications, 2015
- 4) “Algorithms for Data Science”, 1st Edition, Steele, Brian, Chandler, John, Reddy, Swarna, springers Publications, 2016

e-Resources:

- 1) <https://github.com/joelgrus/data-science-from-scratch>

Subject Code	Subject Name	L	T	P	C
R19CSS-PE4102.2	Professional Elective- IV Social Networks & Semantic Web	3	0	0	3

Course Objectives

- To learn Web Intelligence, Knowledge Representation for the Semantic Web
- To learn Ontology Engineering, Semantic Web Applications, Services and Technology
- To learn and understand Social Network Analysis and semantic web, role of ontology and inference engines in semantic web
- To explain the analysis of the social Web and the design of a new class of applications that combine human intelligence with machine processing.
- To describe how the Semantic Web provides the key in aggregating information across heterogeneous sources.

Course Outcomes

After Completion of this course Students will be able to

- Ability to understand and knowledge representation for the semantic web and ontology
- Ability to build a blogs and social networks and basics of Semantic Web and Social Networks.
- Understand Electronic sources for network analysis and different Ontology languages.
- Modeling and aggregating social network data and Develop social-semantic applications.
- Evaluate Web- based social network and Ontology.

UNIT –I: Web Intelligence

Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today’s Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Web Applications and Logic on the Semantic Web. (L2)

UNIT -II: Knowledge Representation for the Semantic Web

Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Knowledge and representation for the semantic web. (L2)

UNIT-III: Ontology Engineering

Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Ontology Engineering and how it’s developed (L2)

UNIT-IV: Semantic Web Applications, Services and Technology

Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods

Learning Outcomes:

At the end of this module student will be able to:

- Summarizing about web applications and services and technologies (L2)

UNIT-V: .Social Network Analysis and semantic web

What is social Networks analysis, Development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Social Network Analysis and Semantic Web (L2)

TEXT BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R.Studer, P.Warren, John Wiley & Sons.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3. Information Sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.
4. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O'Reilly, SPD.

Subject Code	Subject Name	L	T	P	C
R19CSS-PE4102.3	Professional Elective- IV Principles of Cyber Security	3	0	0	3

COURSE OBJECTIVES:

- To learn threats and risks within context of the cyber security architecture.
- Student should learn and Identify security tools and hardening techniques.
- To learn types of incidents including categories,
- Responses and timelines for response.

COURSE OUTCOMES:

At the end of the course, student will be able to

- Apply cyber security architecture principles.
- Describe risk management processes and practices.
- Appraise cyber security incidents to apply appropriate response
- Distinguish system and application security threats and vulnerabilities.
- Identify security tools and hardening techniques.

UNIT-I:

Introduction to Cyber security- Cyber security objectives, Cyber security roles, Differences between Information Security & Cyber security, Cyber security Principles Confidentiality, integrity, & availability Authentication & non- repudiation.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Cyber Security and Principles of Confidentiality (L2)

UNIT-II:

Information Security (IS) within Lifecycle Management-Lifecycle management landscape, Security architecture processes, Security architecture tools, Intermediate lifecycle management concepts, Risks & Vulnerabilities-Basics of risk management, Operational threat environments, Classes of attacks.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Information Security within Management Lifecycle (L2)

UNIT-III:

Incident Response- Incident categories, Incident response Incident recovery, and Operational security protection: Digital and data assets, ports and protocols, Protection technologies, Identity and access Management, configuration management.

Learning Outcomes:

At the end of this module student will be able to:

- Summarizing and Understanding about Incident Response, Operational Protection (L2)

UNIT-IV:

Threat Detection and Evaluation (DE): Monitoring- Vulnerability Management, Security Logs and Alerts, Monitoring Tools and Appliances. Analysis- Network traffic Analysis, packet capture and analysis

Learning Outcomes:

At the end of this module student will be able to:

- Summarizing about Threat Detection and Evaluation. (L2)

UNIT-V:

Introduction to backdoor System and security-Introduction to metasploit, Backdoor, demilitarized zone(DMZ),Digital Signature, Brief study on Harding of operating system.

Learning Outcomes:

At the end of this module student will be able to:

- Understanding about Backdoor system and Security. (L2)

TEXT BOOKS:

1. NASSCOM: Security Analyst Student Hand Book.
2. Information Security Management Principles Updated Edition by David Alexander, Amanda Finch, David Sutton ,Published by BCS.

REFERENCE BOOKS:

1. CSX- cyber security fundamentals , Published by ISACA, Cyber security, Network Security, Data Governance Security.

Subject Code	Subject Name	L	T	P	C
R19CSS-PE4102.4	Professional Elective- IV UML & Design Patterns	3	0	0	3

COURSE OBJECTIVES:

- To understand design patterns and their underlying object oriented concepts.
- To understand implementation of design patterns and providing solutions to real world software design problems.
- To understand patterns with each other and understanding the consequences of combining patterns on the overall quality of a system.
- To understand how to solve complex problems
- Study the notations of Unified Modelling Language

LEARNING OUTCOMES:

- Understand how to Represent classes, responsibilities and states using UML notation
- Apply various patterns to find solutions to the complex problems
- Understand how to Identify classes and responsibilities of the problem domain

UNIT 1:

Introduction to UML: Why we model, Conceptual model of UML, Architecture, Classes, Relationships, Common Mechanisms, Class diagrams, Object diagrams.

Learning Outcomes: student will be able to

- Understand the model and its concepts
- Understand the class and object diagrams
- Analyze the relationship between the classes and objects.

UNITII:

Basic Behavioural Modelling: Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams.

Advanced Behavioural Modelling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

Learning Outcomes: student will be able to

- Understand what is use case and the relationship between actor and use cases
- Understand interaction and activity diagrams
- Understand the advanced behavioural modelling concepts
- Understand state chart diagrams and its concepts

UNIT III:

Architectural Modelling: Component, Deployment, Component diagrams and Deployment diagrams. Case Study: The Unified Library application.

Patterns:Pattern Description, organizing catalogues, role in solving design problems, Selection and usage.

Learning Outcomes: student will be able to

- Understand component and deployment diagrams and some applications
- Understand the concept of patterns in solving design problems

UNIT IV:

Creational Patterns: Abstract factory, Builder, Factory method, Prototype, Singleton

Structural Patterns: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, PROXY.

Learning Outcomes: student will be able to

- Understand about Creational and structural patterns

- Apply the concepts on various applications

UNIT V:

Behavioural Patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor

A Case Study (Designing a Document Editor): Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation.

Learning Outcomes: student will be able to

- Understand the behavioural patterns and various methods
- Apply the patterns on one of the case study

TEXT BOOKS:

- 1) “Object- Oriented Analysis And Design with Applications”, Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, 3rd edition, 2013, PEARSON.
- 2) “The Unified Modelling Language User Guide”, Grady Booch, James Rumbaugh, Ivar Jacobson, 12th Impression, 2012, PEARSON.
- 3) Design Patterns, Erich Gamma, Pearson Education, 1995.

REFERENCE BOOKS:

- 1) “Object-oriented analysis and design using UML”, Mahesh P. Matha, PHI
- 2) “Head first object-oriented analysis and design”, Brett D. McLaughlin, Gary Pollice, Dave West, O’Reilly
- 3) “Object-oriented analysis and design with the Unified process”, John W. Satzinger, Robert B. Jackson, Stephen D. Burd, Cengage Learning
- 4) “The Unified modelling language Reference manual”, James Rumbaugh, Ivar Jacobson, Grady Booch, Addison-Wesley
- 5) Head First Design patterns, Eric Freeman & Elisabeth Freeman, O’REILLY, 2007.
- 6) Design Patterns in Java, Steven John Metsker& William C. Wake, Pearson education, 2006
- 7) J2EE Patterns, Deepak Alur, John Crupi& Dan Malks, Pearson education, 2003.
- 8) Design Patterns in C#, Steven John metsker, Pearson education, 2004.

Subject Code	Subject Name	L	T	P	C
R19CSS-PC4103	AI TOOLS & TECHNIQUES LAB	0	0	3	1.5

Course Outcomes:

- Students will be able to apply logic of AI using Python
- Students will be able to relate methods for encoding Knowledge In computer systems
- Students will be able to Interpret the Problems and search related to AI
- Students will be able to infer Slot-and-filler structures and architecture of neural networks as connectionist models
- Demonstrate the basic concepts of artificial intelligence in the Laboratory

1. (a). Write a python program to print the multiplication table for the given number?
(b). Write a python program to check whether the given number is prime or not?
(c) Write a python program to find factorial of the given number?

2. Write a python program to implement simple Chatbot?

3. (a) Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing)?
(b) Write a python program to implement List methods (Add, Append, Extend & Delete).

4. (a). Write a python program to Illustrate Different Set Operations?
(b). Write a python program to generate Calendar for the given month and year?
(c). Write a python program to implement Simple Calculator program?

5. (a). Write a python program to Add Two Matrices.
(b). Write a python program to Transpose a Matrix.

6. Write a python program to implement Breadth First Search Traversal?

7. Write a python program to implement Water Jug Problem?

8. (a) Write a python program to remove punctuations from the given string?
(b) Write a python program to sort the sentence in alphabetical order?

9. Write a program to implement Hangman game using python.

10. Write a program to implement Tic-Tac-Toe game using python.

- 11.(a) Write a python program to remove stop words for a given passage from a text file using NLTK?
(b) Write a python program to implement stemming for a given sentence using NLTK?
(c) Write a python program to POS (Parts of Speech) tagging for the give sentence using NLTK?

12. (a) Write a python program to implement Lemmatization using NLTK?
(b) Write a python program to for Text Classification for the give sentence using NLTK?

IV Year – II SEMESTER							
S.No	Course Code	Course Title	Category	L	T	P	Credits
1		<i>Machine Learning</i>	HM	3	0	0	3
2		<i>Open Elective- III (Inter Disciplinary)</i> 1. Virtual Reality 2. Green EnergySystems 3. NetworkingAnalysis 4. NPTEL Course	OE	3	0	0	3
3		<i>Professional Elective-V</i> 1. Deep Learning 2. Natural Language Processing 3. Ad-hoc and Sensor Networks 4. NPTEL Course	PE	3	0	0	3
3		Seminar		0	0	0	1
4		Project- II	PR	0	0	16	8
Total				9	0	16	18

Subject Code	Subject Name	L	T	P	C
IV-II	Machine Learning	3	0	0	3

COURSE OBJECTIVES:

- Familiarity with a set of well-known supervised, unsupervised and semi-supervised • learning algorithms.
- The ability to implement some basic machine learning algorithms
- Understanding of how machine learning algorithms are evaluate
- Applying new concepts in machine learning

COURSE OUTCOMES:

- Understand the characteristics of machine learning that make it useful to real-world Problems.
- Remember machine learning algorithms as supervised, semi-supervised, and Unsupervised.
- Analyse few machine learning toolboxes, support vector machines.
- Apply regularized regression algorithms.
- Understand the concept behind neural networks for learning non-linear functions.

UNIT -I:The ingredients of machine learning: Tasks: the problems that can be solved with machine learning, Models: the output of machine learning, Features, the workhorses of machine learning. **Binary classification and related tasks:** Classification, Scoring and ranking,

Learning Outcomes: student will be able to

- Understand machine learning algorithms as supervised, semi-supervised, and Unsupervised.
- Understand Binary classification and its related concepts

UNIT- II:Beyond binary classification: Handling more than two classes, Regression, Unsupervised and descriptive learning. **Tree models:** Decision trees, Ranking and probability estimation trees, Tree learning as variance reduction.

Learning Outcomes: student will be able to

- Understand how to handle more than two classes
- Understand Decision tree construction and its probability estimation

UNIT- III:

Rule models: Learning ordered rule lists, Learning unordered rule sets, Descriptive rule learning, First-order rule learning

Linear models: The least-squares method, The perceptron: a heuristic learning algorithm for linear classifiers, Support vector machines, obtaining probabilities from linear classifiers, Going beyond linearity with kernel methods.

Learning Outcomes: student will be able to

- Understand and apply various Rule models.
- Apply Linear Model methods and Support vector machines.

UNIT -IV:

Distance Based Models: Introduction, Neighbours and exemplars, Nearest Neighbours classification, Distance Based Clustering, Hierarchical Clustering.

Probabilistic models: The normal distribution and its geometric interpretations, Probabilistic models for categorical data, Discriminative learning by optimising conditional likelihood Probabilistic models with hidden variables.

Model ensembles: Bagging and random forests, Boosting

Learning Outcomes: student will be able to

- Understand probabilistic Models and optimization in the models.
- Apply Distance based models with various algorithms like KNN etc.
- understand Clustering and Ensemble Methods, Random Forest, Boosting algorithms on the data sets

UNIT- V:

Dimensionality Reduction: Principal Component Analysis (PCA), Implementation and demonstration.

Artificial Neural Networks: Introduction, Neural network representation, appropriate problems for neural network learning, Multilayer networks, and the back propagation algorithm.

Learning Outcomes: student will be able to

- Apply Dimensionality reduction and learn PCA
- Understand ANN, CNN and back propagation algorithms.

TEXTBOOKS:

1. Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge.
2. Machine Learning, Tom M. Mitchell, MGH.

REFERENCE BOOKS:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Bendavid, Cambridge.
2. Machine Learning in Action, Peter Harington, 2012, Cengage.

Subject Code	Subject Name	L	T	P	C
IV-II	Open Elective – III Virtual Reality	3	0	0	3

COURSE OBJECTIVES:

- Design a virtual environment and compelling virtual reality experience.
- Create compelling virtual experiences.
- Comprehend and analyze the fundamental issues of virtual reality.
- Comprehend the IEEE VR proceedings

COURSE OUTCOMES:

- Demonstrate an understanding of techniques, processes, technologies and equipment used in immersive virtual reality;
- Exploit the characteristics of materials and processes in an individual and conceptually developed way;
- Show critical awareness of historical and theoretical contexts relevant to immersive virtual reality;
- Apply critical, analytical and self-reflective practice;
- Identify and develop personal topics for individual research in immersive virtual reality.

UNIT-I

Introduction : The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. (1.1, 1.3 and 1.5 of Text Book (1))

Learning Outcomes: student will be able to

- Understanding Virtual Reality
- Understand Components of VR System.

UNIT – II

Input Devices : (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. (2.1, 2.2 and 2.3 of Text Book (1)).

Learning Outcomes: student will be able to

- Understanding about VR Input Devices
- Understand about Interfaces and Gesture Interfaces.

UNIT - III

Output Devices: Graphics displays, sound displays & haptic feedback. (3.1,3.2 & 3.3 of Text Book(1))

Modeling : Geometric modeling, kinematics modeling, physical modeling, behaviour modeling,model management. (5.1, 5.2 and 5.3, 5.4 and 5.5 of Text Book (1)).

Learning Outcomes: student will be able to

- Understanding Output Devices and Graphics Displays

UNIT – IV

Human Factors: Methodology and terminology, user performance studies, VR health and safety issues. (7.1, 7.2 and 7.3 of Text Book (1)).

Applications: Medical applications, military applications, robotics applications. (8.1, 8.3 and 9.2 of Text Book (1)).

Learning Outcomes: student will be able to

- Applications which are using VR System

UNIT – V

VR Programming-I : Introducing Java 3D, loading and manipulating external models, using a latheto make shapes. (Chapters 14, 16 and 17 of Text Book (2))

Learning Outcomes: student will be able to

- Understanding VR Programming using JAVA 3D.

TEXT BOOKS :

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea& Philippe Coiffet, John Wiley & Sons, Inc.,
2. Killer Game Programming in Java, Andrew Davison, Oreilly-SPD, 2005.

REFERENCES :

1. Understanding Virtual Reality, interface, Application and Design, William R.Sherman, Alan Craig, Elsevier(Morgan Kaufmann).
2. 3D Modeling and surfacing, Bill Fleming, Elsevier(Morgan Kauffman).
3. 3D Game Engine Design, David H.Eberly, Elsevier.
4. Virtual Reality Systems, John Vince, Pearson Education.

Subject Code	Subject Name	L	T	P	C
IV-II	Professional Elective - V Deep Learning	3	0	0	3

Course Objectives:

- To acquire knowledge on the basics of neural networks.
- To implement neural networks using computational tools for variety of problems.
- To explore various deep learning algorithms.

Course Outcomes:

Students will be able to:

- Develop algorithms simulating human brain.
- Implement Neural Networks in Tensor Flow for solving problems.
- Explore the essentials of Deep Learning and Deep Network architectures.
- Define, train and use a Deep Neural Network for solving real world problems that require artificial Intelligence based solutions.

UNIT-I

Introduction to Deep Learning, Bayesian Learning, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization

Learning Outcomes: student will be able to

- Student will be able to learn about Deep Learning and Techniques

UNIT-II

Introduction to Neural Network, Multilayer Perceptron, Back Propagation, Learning Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning

Learning Outcomes: student will be able to

- Understanding about Neural Network

UNIT-III

Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam, Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization

Learning Outcomes: student will be able to

- Understanding about Revisiting Gradient Descent.

UNIT-IV

Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN etc. Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection etc.

Learning Outcomes: student will be able to

- Understanding about Deep Learning Architectures.

UNIT-V

LSTM Networks, Generative Modelling with DL, Variational Autoencoder, Generative Adversarial Network, Revisiting Gradient Descent

Learning Outcomes:

student will be able to

- Understanding about LSTM Networks.

Text Books:

1) "Deep Learning (Adaptive Computation and Machine Learning series)", Ian Goodfellow,

YoshuaBengio, Aaron Courville, MIT Press, 2017.

2) Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

3) “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, Nikhil Buduma, Nicholas Locascio, O'Reilly Media, 2017.

Reference Books:

1) Deep learning from first principle,2nd edition, tinniam v Ganesh,2018

2) Introduction to Deep Learning ,1st edition, by Eugene charniak, The MIT Press,2019

Subject Code	Subject Name	L	T	P	C
IV-II	Professional Elective - V <i>Natural Language Processing</i>	3	0	0	3

Course Objectives:

- Teach students the leading trends and systems in natural language processing.
- Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
- Teach them to recognize the significance of pragmatics for natural language understanding.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

COURSE OUTCOMES:

- Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
- Able to design, implement, and analyze NLP algorithms
- Able to design different language modeling Techniques.

Unit-I

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

Learning Outcomes:

student will be able to

- Understanding Structure of Words.
- Summarizing the structure of Documents, methods and Complexity of the Approaches.

Unit-II

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

Learning Outcomes:

student will be able to

- Understanding Syntax Analysis and Parsing Algorithms.

Unit-III

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

Learning Outcomes:

student will be able to

- Understanding Semantic Parsing and Paradigms.

Unit-IV

Predicate-Argument Structure Predicate-Argument Structure, Meaning Representation Systems, Software.

Learning Outcomes:

student will be able to

- Understanding Predicate – Argument Structure using software.

Unit-V

Discourse Processing: Cohesion, Reference Resolution, Discourse Cohesion and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language Specific Modeling Problems, Multilingual and Crosslingual Language Modeling

Learning Outcomes:

student will be able to

- Understanding Discourse Processing Types of Language Models.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOKS:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications

Subject Code	Subject Name	L	T	P	C
IV-II	Professional Elective - V Ad-hoc and Sensor Networks	3	0	0	3

OBJECTIVES:

- To learn about the issues and challenges in the design of wireless ad hoc networks.
- To understand the working of MAC and Routing Protocols for ad hoc and sensor networks
- To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks.
- To understand various security issues in ad hoc and sensor networks and the corresponding solutions.

COURSE OUTCOMES:

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

- Identify different issues in wireless ad hoc and sensor networks .
- To analyze protocols developed for ad hoc and sensor networks .
- To identify and understand security issues in ad hoc and sensor networks.

UNIT I

MAC & ROUTING IN AD HOC NETWORKS

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols

Learning Outcomes:

student will be able to

- Understanding Mac & Routing in Ad HOC Networks

UNIT II

TRANSPORT & QOS IN AD HOC NETWORKS

TCP's challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model

Learning Outcomes:

student will be able to

- Understanding Transport & QOS in Ad HOC Networks

UNIT III

MAC & ROUTING IN WIRELESS SENSOR NETWORKS

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention-Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols

Learning Outcomes:

student will be able to

- Understanding MAC & Routing in Wireless Sensor Networks

UNITIV

TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples

Learning Outcomes:

student will be able to

- Understanding Transport & QOS in wireless sensor networks

UNITV

SECURITY IN AD HOC AND SENSOR NETWORKS

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

Learning Outcomes:

student will be able to

- Summarizing Security in AD HOC & Sensor Networks

TEXT BOOKS:

1. C.Siva Ram Murthy and B.S.Manoj, —Ad Hoc Wireless Networks – Architectures and 2 Protocols, Pearson Education, 2006.
2. Holger Karl, Andreas Willing, —Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Inc., 2005.

REFERENCES:

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, —Ad Hoc Mobile Wireless Networks, Auerbach Publications, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, —Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition), World Scientific Publishing, 2011.
3. WaltenegusDargie, Christian Poellabauer, —Fundamentals of Wireless Sensor Networks Theory and Practice, John Wiley and Sons, 2010
4. Xiang-Yang Li , “Wireless Ad Hoc and Sensor Networks: Theory and Applications, 1227 th edition, Cambridge university Press,2008.