JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

COURSE STRUCTURE AND SYLLABUS

For UG – R20

B. Tech - COMPUTER SCIENCE AND ENGINEERING with Specialization

ARTIFICIAL INTELLIGENCE

(Applicable for batches admitted from 2020-2021)

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DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B. Tech –I Semester(Tentative)						
S.No	**Course Code**	**Course Title**	**Hours per week**			**Credits**
			L	**T**	**P**	**C**
1	PE	**Professional Elective-III** 1. Reinforcement Learning 2. Soft Computing 3. Cryptography and Network Security 4. Block Chain Technologies 5. Speech Processing	3	0	0	3
2	PE	**Professional Elective-IV** 1. Robotic Process Automation 2. Cloud Computing 3. Big Data Analytics 4. NOSQL Databases 5. Video Analytics	3	0	0	3
3	PE	**Professional Elective-V** 1. Social Network Analysis 2. Recommender Systems 3. AI Chatbots 4. Object Oriented Analysis and Design 5. Semantic Web	3	0	0	3
4	Open Elective /Job Oriented	**Open Elective-III** Open Electives offered by other departments/API and Microservices (Job Oriented Course)	3	0	0	3
5	Open Elective /Job Oriented	**Open Elective-IV** Open Electives offered by other departments/Secure Coding Techniques (Job Oriented Course)	3	0	0	3
6	HS	Universal Human Values 2: Understanding Harmony	3	0	0	3
7	SO	1. Machine Learning with Go (Infosys Spring Board) **OR** 2. MEAN Stack Technologies- Angular JS and MongoDB	0	0	4	2
8	PR	**Industrial/Research Internship 2 months (Mandatory) after third year (to be evaluated during VII semester**	0	0	0	3
Total credits						**23**
9	Minor	Reinforcement Learning	4	0	0	4
Minor courses through SWAYAM			0	0	0	2

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B. Tech –II Semester						
S.No	**Course Code**	**Course Title**	**Hours per week**			**Credits**
			L	**T**	**P**	**C**
1	Project	Major Project Work, Seminar, Internship	-	-	-	12
Total credits						**12**

SUGGESTED COURSES MINOR ENGINEERING IN B.TECH.CSE- AI

Eligibility for Minor in CSE-AI:- ---

Note:

1. TWO, NPTEL courses of EIGHT week duration covering a total of 4 credits (offered by CSE Department only), Student can register at any time after the completion of II B.Tech. I Sem.

S.No.	Course Title	Credits
1	Introduction to Artificial Intelligence	4
2	Machine Learning	4
3	Deep Learning	4
4	Reinforcement Learning	4
5	MOOCS Courses ** 1. Introduction to Soft Computing(NPTEL) (https://nptel.ac.in/courses/106105173) 2. Design of Internet of Things(NPTEL) (https://nptel.ac.in/courses/108108179) 3. Cloud Computing (NPTEL) (https://nptel.ac.in/courses/106105167) 4. Digital Speech Processing (NPTEL) (https://nptel.ac.in/courses/117105145)	4
	Total	20

**Choose 02 MOOCS courses @ 2credits each from SWAYAM/NPTEL

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
REINFORCEMENT LEARNING (Professional Elective-III)					

Course Objective:

- Learn various approaches to solve decision problems with functional models and algorithms for task formulation, Tabular based solutions, Function approximation solutions, policy gradients and model based reinforcement learning.

Course Outcomes:

By completing the course the students will be able to:

- Understand basic concepts of Reinforcement learning
- Identifying appropriate learning tasks for Reinforcement learning techniques
- Understand various methods and applications of reinforcement learning

UNIT I:

Introduction: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe

Multi-armed Bandits: A k-armed Bandit Problem, Action-value methods, The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper – Confidence-Bound Action Selection, Gradient Bandit Algorithm

UNIT II:

Finite Markov Decision Process: The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notataion for Episodic and Continuing Tasks, Policies and Value Functions,

Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming

UNITIII:

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Discontinuing-aware Importance Sampling, Per-decision Importance Sampling

***n*-step Bootstrapping:** *n*-step TD Prediction, *n*-step Sarsa, *n*-step Off-policy Learning, Per-decision methods with Control Variables, A Unifying Algorithm: *n*-step Q(σ)

UNIT IV:

Off-policy Methods with Approximation: Semi-gradient Methods, Examples of Off-policy Divergence, The Deadly Triad, Linear Value-function Geometry, Gradient Descent in the Bellman Error, The Bellman Error is not Learnable, Gradient-TD methods, Emphatic-TD methods, Reducing Variance

Eligibility Traces: The λ-return, TD(λ), *n*-step Truncated λ-return methods, Online λ –return Algorithm, True Online TD(λ), Dutch Traces in Monte Carlo Learning, Sarsa(λ), Variable λ and γ, Off-policy Traces with Control Variables, Watkins's Q(λ) to Tree-Backup(λ)

UNITV:

Policy Gradient Methods: Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFOECE: Monte Carlo Policy Gradient, REINFORCE with Baseline, Actor-Critic Methods, Policy Gradient for Continuing Problems, Policy Parameterization fr Continuous Actions

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

Applications and Case Studies: TD-Gammon, Samuel's Checkers Player, Watson's Daily Double Wagering, Optimizing Memory Control, Personalized Web Services

Text Books:

1. R. S. Sutton and A. G. Bart,. "Reinforcement Learning - An Introduction," MIT Press, 2018.

References:

1. Szepesvári, Csaba, "Algorithms for Reinforcement Learning," United States: Morgan & Claypool, 2010.
2. Puterman, Martin L., "Markov Decision Processes: Discrete Stochastic Dynamic Programming," Germany: Wiley, 2014.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_cs74/preview

https://www.coursera.org/learn/fundamentals-of-reinforcement-learning

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
SOFT COMPUTING (Professional Elective-III)					

Course Objectives: In the course the student will Learn soft computing concepts and techniques and foster their abilities in designing and implementing soft computing based solutions for real-world problems.

Course Outcomes (COs):
At the end of the course, student will be able to

- Able to apply fuzzy logic and reasoning to handle uncertainty in engineering problems Make use of genetic algorithms to combinatorial optimization problems
- Apply artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning.
- Learn and apply the principles of self adopting and self organizingneuro fuzzy inference systems
- Evaluate and compare solutions by various soft computing approaches for a given problem

UNIT I:
Fuzzy Set Theory: Introduction to Neuro – Fuzzy and Soft Computing, Fuzzy Sets, Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations. Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models.

UNIT II:
Optimization: Derivative based Optimization, Descent Methods, The Method ofSteepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms.

UNIT III:
Artificial Intelligence: Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning, Heuristic Search: Techniques for Heuristic search Heuristic Classification.

UNIT IV:
Neuro Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems, Architecture, Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN, Framework Neuron Functions for Adaptive Networks, Neuro Fuzzy Spectrum.

UNIT V:
Applications Of Computational Intelligence: Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Color Recipe Prediction.

Text Books:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004
2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2006.

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

Reference Books:

1. Elaine Rich & Kevin Knight, Artificial Intelligence, Second Edition, Tata Mcgraw Hill Publishing Comp., 2006, New Delhi.
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
4. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI,
5. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996.
6. AmitKonar, "Artificial Intelligence and Soft Computing Behaviour and Cognitive model of the human brain", CRC Press, 2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
CRYPTOGRAPHY AND NETWORK SECURITY (Professional Elective-III)					

Course Objectives:
The main objectives of this course are to explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms, design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and SSL/TLS.

Course Outcomes: At the end of the course, student will be able to
- Explain different security threats and countermeasures and foundation course of cryptography mathematics.
- Classify the basic principles of symmetric key algorithms and operations of some symmetric key algorithms and asymmetric key cryptography
- Revise the basic principles of Public key algorithms and Working operations of some Asymmetric key algorithms such as RSA, ECC and some more
- Design applications of hash algorithms, digital signatures and key management techniques
- Determine the knowledge of Application layer, Transport layer and Network layer security Protocols such as PGP, S/MIME, SSL,TSL, and IPsec .

UNIT I:
Basic Principles: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography.

UNIT II:
Symmetric Encryption: Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.

UNIT III:
Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography

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

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

Text Books:
1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Cryptography and Network Security,4th Edition, William Stallings, (6e) Pearson,2006
3. Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

Reference Books:

1. Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning,2018

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
BLOCK CHAIN TECHNOLOGIES (Professional Elective-III)					

Course Objectives:
To understand block chain technology and Cryptocurrency works

Course Outcomes:
After the completion of the course, student will be able to

- Demonstrate the block chain basics, Crypto currency
- To compare and contrast the use of different private vs. public block chain and use cases
- Design an innovative Bit coin Block chain and scripts, Block chain Science on varies coins
- Classify Permission Block chain and use cases – Hyper ledger, Corda
- Make Use of Block-chain in E-Governance, Land Registration, Medical Information Systems and others

UNIT I:
Introduction: Introduction, basic ideas behind block chain, how it is changing the landscape ofdigitalization, introduction to cryptographic concepts required, Block chain or distributed trust, Currency, Cryptocurrency, How a Cryptocurrency works, Financial services, Bitcoin prediction markets.

UNIT II:
Hashing, public key cryptosystems, private vs public block chain and use cases, HashPuzzles, Extensibility of Block chain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Block chain Environment

UNIT III:
Introduction to Bitcoin : Bitcoin Block chain and scripts, Use cases of BitcoinBlockchain scripting language in micropayment, escrow etc Downside of Bit coin mining, Block chain Science: Grid coin, Folding coin, Block chain Genomics, Bit coin MOOCs.

UNIT IV:
Ethereum continued, IOTA, The real need for mining, consensus, Byzantine Generals Problem, and Consensus as a distributed coordination problem, Coming to private or permissioned block chains, Introduction to Hyper ledger, Currency, Token, Campus coin, Coin drop as a strategy for Public adoption,Currency Multiplicity, Demurrage currency

UNIT V:
Technical challenges, Business model challenges, Scandals and Public perception,Government Regulations, Uses of Block chain in E-Governance, Land Registration, Medical Information Systems.

Text Books:
1. Blockchain Blue print for Economy by Melanie Swan

Reference Books:
1. Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition, by Daniel Drescher

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
SPEECH PROCESSING (Professional Elective-III)					

Course Objectives:
The main objective of the course is tounderstand the basic principles of sound and speech production and perception, speech recognition, synthesis and dialogue systems

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

- Understand the speech production and perception process.
- Analyze speech signals in time and frequency domain.
- Design and implement algorithms for processing speech signals.

UNIT I:
Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production-Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals.

UNIT II:
Time Domain Models for Speech Processing: Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech Vs Silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT III:
Linear Predictive Coding (LPC) Analysis: Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

UNIT IV:
Homomorphic Speech Processing: Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The HomomorphicVocoder. Speech Enhancement: Nature of interfering sounds, Speech enhancement techniques: Single Microphone Approach : spectral subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi microphone Approach

UNITV:
Automatic Speech & Speaker Recognition: Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Hidden Markov Model (HMM) for Speech: Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS. Speaker Recognition: Recognition techniques, Features that distinguish speakers, Speaker Recognition Systems: Speaker

Verification System, Speaker Identification System.

Text Books:

1. L.R. Rabiner and S. W. Schafer, "Digital Processing of Speech Signals", Pearson Education.
2. Douglas O'Shaughnessy, "Speech Communications: Human & Machine", 2nd Ed., Wiley India, 2000.
3. L.R Rabinar and R W Jhaung, "Digital Processing of Speech Signals", 1978, Pearson Education.

Reference Books:

1. Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice", 1st Edition., PE.
2. Ben Gold & Nelson Morgan, "Speech & Audio Signal Processing", 1st Edition, Wiley

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
ROBOTIC PROCESS AUTOMATION (Professional Elective-IV)					

Course Outcomes:

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

- Describe RPA, where it can be applied and how it's implemented.
- Describe the different types of variables, Control Flow and data manipulation techniques.
- Identify and understand Image, Text and Data Tables Automation.
- Describe how to handle the User Events and various types of Exceptions and strategies.
- Understand the Deployment of the Robot and to maintain the connection.

UNIT I :

Introduction to Robotic Process Automation: Scope and techniques of automation, Robotic process automation, What can RPA do, Benefits of RPA, Components of RPA, RPA platforms, The future of automation.

RPA Basics: History of Automation, What is RPA, RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads which can be automated, RPA Advanced Concepts, Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team, Process Design Document/Solution Design Document, Industries best suited for RPA, Risks & Challenges with RPA, RPA and emerging ecosystem.

UNIT II:

RPA Tool Introduction and Basics:

Introduction to RPA Tool: The User Interface, Variables, Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables, Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel, Using Arguments, About Imported Namespaces, Importing New Namespaces, Control Flow, Control Flow Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, About Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity, Data Manipulation, Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data

UNIT III:

Advanced Automation Concepts & Techniques: Recording Introduction, Basic and Desktop Recording, Web Recording, Input/ Output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques, Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge, Image, Text & Advanced Citrix Automation, Introduction to Image & Text Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps, Excel Data Tables & PDF, Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

UNIT IV:

Handling User Events & Assistant Bots, Exception Handling: What are assistant bots, Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger, Monitoring image and element triggers, An example of monitoring email, Example of monitoring a copying event and blocking it, Launching an assistant bot on a keyboard event.

Exception Handling: Debugging and Exception Handling, Debugging Tools, Strategies for solving issues, Catching errors.

UNIT V:

Deploying and Maintaining The Bot: Publishing using publish utility, Creation of Server, Using Server to control the bots, Creating a provision Robot from the Server, Connecting a Robot to Server, Deploy the Robot to Server, Publishing and managing updates, Managing packages, Uploading packages, Deleting packages

Text Books:

1. Alok Mani Tripathi, "*Learning Robotic Process Automation*", Packt Publishing, 2018.

Reference Books:

1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "Introduction to Robotic Process Automation:a Primer", Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate RepetitiveTasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
3. Srikanth Merianda, "Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots andautomate business processes", Packt Publishing, 1st Edition 2018.

Web References:

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
CLOUD COMPUTING (Professional Elective-IV)					

Course Objectives:

- To explain the evolving computer model caned cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.
- To motivate students to do programming and experiment with the various cloud computing environments.

Course Outcomes: At the end of the course, student will be able to

- Illustrate the key dimensions of the challenge of Cloud Computing
- Classify the Levels of Virtualization and mechanism of tools.
- Analyze Cloud infrastructure including Google Cloud and Amazon Cloud.
- Create Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud
- Assess control storage systems and cloud security, the risks involved its impact and develop cloud application

UNIT I:
Systems Modeling, Clustering and Virtualization: Scalable Computing over the Internet-The Age of Internet Computing, Scalable computing over the internet, Technologies for Network Based Systems, System models for Distributed and Cloud Computing, , Performance, Security and Energy Efficiency

UNIT II:
Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT III:
Cloud Platform Architecture: Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS and Microsoft Azure

UNIT IV:
Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing.

UNIT V: Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

Text Books:

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.

Reference Books:

1. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
3. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
BIG DATA ANALYTICS (Professional Elective-IV)					

Course Objectives:

- To optimize business decisions and create competitive advantage with Big Data analytics
- To learn to analyze the big data using intelligent techniques
- To introduce programming tools PIG & HIVE in Hadoop echo system

Course Outcomes:

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

- Illustrate big data challenges in different domains including social media, transportation, finance and medicine
- Use various techniques for mining data stream
- Design and develop Hadoop
- Identify the characteristics of datasets and compare the trivial data and big data forvarious applications
- Explore the various search methods and visualization techniques

UNIT I:

Introduction: Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.

UNIT II:

Stream Processing: Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions.

UNIT III:

Introduction to Hadoop: Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, 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.

UNIT IV:

Frameworks and Applications: 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.

UNIT V:

Predictive Analytics and Visualizations: Predictive Analytics, Simple linear regression, Multiple linear regression, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application

Text Books:

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'reilly Media, Fourth Edition, 2015.
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.
3. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012

Reference Books:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.
2. Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big Data:The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.
3. Arshdeep Bahga and Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ", VPT, 2016.
4. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons, 2014.

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
NOSQL DATABASES (Professional Elective-IV)					

Course Objective: The student will be able to

- Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tuneDocument-oriented NoSQL databases.

Course Outcomes: At the end of the course, student will be able to

- Discuss about Aggregate Data Models
- Explain about Master-Slave Replication, Peer-to-Peer Replication
- Describe the Structure of Data, Scaling, Suitable Use Cases
- Make use of Complex Transactions Spanning Different Operations
- Identify Routing, Dispatch and Location-Based Services

UNIT-I:
Why NoSQL, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schema less Databases, Materialized Views, Modelling for Data Access,

UNIT-II:
Distribution Models: Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Shading and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes

UNIT-III:
What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets.

UNIT-IV:
Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, Ecommerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure

UNIT-V:

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

Graph Databases, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch and Location-Based Services, Recommendation Engines, When Not to Use

TextBooks:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012

Reference Books:

1. Dan Sullivan, "NoSQLFor Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
VIDEO ANALYTICS (Professional Elective-IV)					

Course Objectives:
The main objectives of the course is to make student understand the need for video Analytics, the basic configuration of video analytics, the functional blocks of a video analytic system and to get exposed to the various applications of video analytics

Course Outcomes:
At the end of the course, the student should be able to:
• Design video analytic algorithms for security applications
• Design video analytic algorithms for business intelligence
• Design custom made video analytics system for the given target application

UNIT I:
Video Analytic Components: Need for Video Analytics, Overview of video Analytics, Foreground extraction, Feature extraction, classifier, Preprocessing, edge detection, smoothening, Feature space-PCA-FLD-SIFT features

UNIT II:
Foreground Extraction: Background estimation, Averaging, Gaussian Mixture Model, Optical Flow based, Image Segmentation, Region growing, Region splitting, Morphological operations, erosion, Dilation, Tracking in a multiple camera environment

UNIT III:
Classifiers: Neural networks (back propagation), Deep learning networks, Fuzzy Classifier, Bayesian classifier, HMM based classifier

UNIT IV:
Video Analytics for Security: Abandoned object detection, human behavioral analysis, human action recognition, perimeter security, crowd analysis and prediction of crowd congestion

UNIT V:
Video Analytics For Business Intelligence & Traffic Monitiring And Assistance: Customer behavior analysis, people counting, Traffic rule violation detection, traffic congestion identification for route planning, driver assistance, lane change warning

Text Books:
1. Graeme A. Jones, Nikos Paragios, Carlo S. Regazzoni, “Video-Based Surveillance Systems: Computer Vision and Distributed Processing”, Kluwer academic publisher, 2001
2. NilanjanDey, AmiraAshour and SuvojitAcharjee, “Applied Video Processing in Surveillance and Monitoring Systems”, (IGI global) 2016

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KAKINADA – 533 003, Andhra Pradesh, India

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Reference Books:

1. Zhihao Chen, Ye Yang, JingyuXue, Liping Ye, FengGuo, "The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite", CreateSpace Independent Publishing Platform, 2014
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
SOCIAL NETWORK ANALYSIS (Professional Elective-V)					

Course Objectives:

- Formalize different types of entities and relationships as nodes and edges and represent thisinformation as relational data
- Plan and execute network analytical computations
- Use advanced network analysis software to generate visualizations and perform empirical investigations of network data
- Interpret and synthesize the meaning of the results with respect to a question, goal, or task
- Collect network data in different ways and from different sources while adhering to legal standards and ethics standards

Course Outcomes:

After completing the course student should:

- Know basic notation and terminology used in network science
- Be able to visualize, summarize and compare networks
- Illustrate basic principles behind network analysis algorithms
- Develop practical skills of network analysis in R programming language
- Be capable of analyzing real work networks

UNIT I:

Social Network Analysis: Preliminaries and definitions, Erdos Number Project, Centrality measures, Balance and Homophily.

UNIT II:

Random graph models**:** Random graphs and alternative models, Models of network growth, Navigation in social Networks, Cohesive subgroups, Multidimensional Scaling, Structural equivalence, roles and positions.

UNIT III:

Network topology and diffusion, Contagion in Networks, Complex contagion, Percolation and information, Navigation in Networks Revisited.

UNIT IV:

Small world experiments, small world models, origins of small world, Heavy tails, Small Diameter, Clustering of connectivity, The Erdos Renyi Model, Clustering Models.

UNIT V:

Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, network formation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.

Text Books:

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

1. S. Wasserman and K. Faust. "Social Network Analysis: Methods and Applications", Cambridge University Press.
2. D. Easley and J. Kleinberg, "Networks, Crowds and Markets: Reasoning about a highly connected world" , Cambridge University Press, 1st edition,2010

Reference Books:

1. Maarten van Steen. "Graph Theory and Complex Networks. An Introduction", 2010.
2. Reza Zafarani, Mohammed Ali Abbasi, Huan Liu. "Social Media Mining: An Introduction". Cambridge University Press 2014.
3. Maksim Tsvetovat and Alexander Kouznetsov. "Social Network Analysis for Startups". O'Reilly Media, 2011.

e-Resources:

1) https://www.classcentral.com/course/edx-social-network-analysis-sna-9134
2) https://www.coursera.org/learn/social-network-analysis

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
RECOMMENDER SYSTEMS (Professional Elective-V)					

Course Objective:
To develop state-of-the-art recommender systems that automates a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations

Course Outcomes:
By completing the course the students will be able to:
- Understand the basic concepts of recommender systems
- Carry out performance evaluation of recommender systems based on various metrics
- Implement machine-learning and data-mining algorithms in recommender systems data sets.
- Design and implement a simple recommender system.

UNIT I :
An Introduction to Recommender Systems: Goals of Recommender Systems, Basic Models of Recommender Systems, Collaborative Filtering Models, Content-Based Recommender Systems, Knowledge-Based Recommender Systems, Domain-Specific Challenges in Recommender Systems, Advanced Topics and Applications.

UNIT II:
Neighborhood-Based Collaborative Filtering: Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood-Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, A Regression Modeling View of Neighborhood Methods, Graph Models for Neighborhood-BasedMethods

UNITIII:
Model-Based Collaborative Filtering: Decision and Regression Trees, Rule-Based Collaborative Filtering, Naïve Bayes Collaborative Filtering, Latent Factor Models, Integrating Factorization and Neighborhood Models

UNIT IV:
Content-Based Recommender Systems: Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations
Knowledge-Based Recommender Systems: Constraint-Based Recommender Systems, Case-Based Recommenders, Persistent Personalization in Knowledge-Based Systems.

UNITV:
Evaluating Recommender Systems: Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

Text Books:

1. Charu .C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.

Reference Books:

1. Jannach D., Zanker M. andFelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.
3. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed.
4. J. Leskovec, A. Rajaraman and J. Ullman, Mining of massive datasets, 2nd Ed., Cambridge, 2012

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
AI CHATBOTS (Professional Elective-V)					

Course Objectives:

- Learn how artificial intelligence powers chatbots, get an overview of the bot ecosystem and bot anatomy, and study different types of bots and use cases.
- Identify best practices for defining a chatbot use case, and use a rapid prototyping framework to develop a use case for a personalized chatbot.

Course Outcomes:

- Develop an in-depth understanding of conversation design, including onboarding, flows, utterances, entities, and personality.
- Design, build, test, and iterate a fully-functional, interactive chatbot using a commercial platform.
- Deploy the finished chatbot for public use and interaction.

UNIT I:

Introduction: Benefits from Chatbots for a Business, A Customer-Centric Approach in Financial Services, Chatbots in the Insurance Industry, Conversational Chatbot Landscape,
Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR)

UNIT II:

Chatbot Development Essentials: Customer Service-Centric Chatbots, Chatbot Development Approaches, Rules-Based Approach, AI-Based Approach, Conversational Flow, Key Terms in Chatbots, Utterance, Intent, Entity, Channel, Human Takeover, Use Case: 24x7 Insurance Agent

UNIT III:

Building a Chatbot Solution: Business Considerations, ChatbotsVs Apps, Growth of Messenger Applications, Direct Contact Vs Chat, Business Benefits of Chatbots, Success Metrics, Customer Satisfaction Index, Completion Rate, Bounce Rate, Managing Risks in Chatbots Service, Generic Solution Architecture for Private Chatbots

UNIT IV:

Natural Language Processing, Understanding, and Generation: Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications.

UNIT V:

Introduction to Microsoft Bot, RASA, and Google Dialog flow: Microsoft Bot Framework, Introduction to QnA Maker, Introduction to LUIS, Introduction to RASA, RASA Core, RASA NLU, Introduction to Dialog flow
Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

Text Books:

1. Abhishek Singh, KarthikRamasubramanian, ShreyShivam, "Building an Enterprise Chatbot: Work with Protected Enterprise Data Using Open Source Frameworks", ISBN 978-1-4842-5034-1, Apress,2019

Reference Books:

1. Janarthanam and Srini, Hands-on chatbots and conversational UI development: Build chatbots and voice user interfaces with C (1 ed.), Packt Publishing Ltd, 2017. ISBN 978-1788294669.
2. Galitsky, Boris., Developing Enterprise Chatbots (1 ed.), Springer International Publishing, 2019. ISBN 978-303004298
3. Kelly III, John E. and Steve Hamm, Smart machines: IBM's Watson and the era of cognitive computing (1 ed.), Columbia University Press, 2013. ISBN 978- 0231168564.
4. Abhishek Singh, KarthikRamasubramanian and ShreyShivam, Building an Enterprise Chatbot (1 ed.), Springer, 2019. ISBN 978-1484250334

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
OBJECT ORIENTED ANALYSIS AND DESIGN (Professional Elective-V)					

Course Objectives: The main objective is the students to

- Become familiar with all phases of OOAD.
- Master the main features of the UML.
- Master the main concepts of Object Technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains.
- Learn the Object design Principles and understand how to apply them towards Implementation.

Course Outcomes: After finishing this course student will be able to:

- Analyze the nature of complex system and its solutions.
- Illustrate & relate the conceptual model of the UML, identify & design the classes and relationships
- Analyze &Design Class and Object Diagrams that represent Static Aspects of a Software System and apply basic and Advanced Structural Modeling Concepts for designing real time applications.
- Analyze & Design behavioral aspects of a Software System using Use Case, Interaction and Activity Diagrams.
- Analyze & Apply techniques of State Chart Diagrams and Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems.

UNIT I:
Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation

UNIT II:
Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.

UNIT III:
Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.

UNIT IV:
Basic Behavioral Modeling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System

UNIT V:
Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams
Case Study: Weather Forecasting
Text Books:

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

1. Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, JimConallen, Kellia Houston , "Object- Oriented Analysis and Design with Applications", 3rd edition, 2013, PEARSON.
2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.

Reference Books:

1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3. AtulKahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

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DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
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SEMANTIC WEB (Professional Elective-V)					

Course Objectives:

- To learn Web Intelligence
- To learn Knowledge Representation for the Semantic Web
- To learn Ontology Engineering
- To learn Semantic Web Applications, Services and Technology
- To learn Social Network Analysis and semantic web

Course Outcomes: After the completion of the course, student will be able to

- Demonstrate social network analysis and measures.
- Analyze random graph models and navigate social networks data
- Apply the network topology and Visualization tools.
- Analyze the experiment with small world models and clustering models.
- Compare the application driven virtual communities from social network Structure.

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.

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.

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.

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,

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.

Text Books:



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

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 – HeinerStuckenschmidt; Frank Van Harmelen, Springer Publications.
4. Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
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API AND MICROSERVICES (Job Oriented Course)					

Course Outcomes:
At the end of this course, the student will be able to

- Develop a Spring Data JPA application with Spring Boot
- Implement CRUD operations using Spring Data JPA
- Implement pagination and sorting mechanism using Spring Data JPA
- Implement query methods for querying the database using Spring Data JPA
- Implement a custom repository to customize a querying mechanism using Spring Data JPA
- Understand update operation using query approaches in Spring Data JPA
- Implement Spring Transaction using Spring Data JPA
- Develop RESTful endpoints using Spring REST Processing URI parameters
- Write RESTful services using Spring REST that consumes and produces data in different formats
- Handle exceptions and errors in Spring REST endpoints
- Write Spring based REST clients to consume RESTful services programmatically
- Create secure RESTful endpoints using Spring Security Document and version the Spring REST endpoints Implement CORS in a Spring REST application

UNIT I:
Spring 5 Basics : Why Spring, What is Spring Framework, Spring Framework - Modules, Configuring IoC container using Java-based configuration, Introduction To Dependency Injection, Constructor Injection, Setter Injection, What is AutoScanning

UNIT II:
Spring Boot: Creating a Spring Boot Application, Spring Boot Application Annotation, What is Autowiring, Scope of a bean, Logger, Introduction to Spring AOP, Implementing AOP advices, Best Practices: Spring Boot Application

UNIT III:
Spring Data JPA with Boot: Limitations of JDBC API, Why Spring Data JPA, Spring Data JPA with Spring Boot, Spring Data JPA Configuration, Pagination and Sorting, Query Approaches, Named Queries and Query, Why Spring Transaction, Spring Declarative Transaction, Update Operation in Spring Data JPA, Custom Repository Implementation, Best Practices - Spring Data JPA

UNIT IV:
Web Services: Why Web services, SOA - Service Oriented Architecture, What are Web Services, Types of Web Services, SOAP based Web Services, RESTful Web Services, How to create RESTful Services

UNIT V:
Spring REST: Spring REST - An Introduction, Creating a Spring REST Controller, @RequestBody and ResponseEntity, Parameter Injection, Usage of @PathVariable, @RequestParam and @MatrixVariable, Exception Handling, Data Validation, Creating a REST Client, Versioning a Spring REST endpoint, Enabling CORS in Spring REST, Securing Spring REST endpoints

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

Hardware and software configuration
- 4 or 8 GB RAM/126 GB ROM
- Swagger tool suite(opensource)
- OpenJDK 17 or Java 11,Maven 3.2 or above and MySQL 8.0 or above,Spring Tool suite, Postman

Text Books:
1. Spring in action, 5th Edition, Author: Craig Walls, Ryan Breidenbach, Manning books

Web Links [Courses mapped to Infosys Springboard platform]:

Infosys Springboard courses:
1. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01296689056211763272_shared/overview [Spring 5 Basics with Spring Boot]
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_4313461831752789500_shared/overview [Spring Data JPA with Boot]
3. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012731900963905536190_shared/overview [Spring REST]

Web references:

1. Dependency Injection in spring - javatpoint
2. Autowiring in Spring - javatpoint
3. https://docs.spring.io/spring-boot/docs/2.0.x/reference/html/using-boot-using-springbootapplication-annotation.html
4. Autowiring in Spring - javatpoint,https://www.baeldung.com/spring-bean-scopes
5. Spring Boot Logging | How does logging works in spring boot with example (educba.com)
6. Spring AOP Tutorial | Aspect Oriented Programming - javatpoint
7. Spring Boot Best Practices (javaguides.net)
8. Introduction to Spring Data JPA | SpringHow
9. https://asbnotebook.com/spring-data-jpa-crud-example/ ,https://www.bezkoder.com/spring-boot-jpa-crud-rest-api/
10. Pagination and Sorting using Spring Data JPA - PagingAndSortingRepository (javaguides.net)
11. https://www.javaguides.net/2018/11/spring-data-jpa-query-creation-from-method-names.html,https://www.javaguides.net/2022/02/spring-data-jpa-namedqueries-example.html
12. https://javadeveloperzone.com/spring/spring-declarative-transaction-management/
13. https://javadeveloperzone.com/spring/spring-declarative-transaction-management/
14. https://javabeat.net/spring-data-custom-repository/
15. https://www.jrebel.com/blog/jpa-application-performance-best-practices
16. https://www.javatpoint.com/service-oriented-architecture,https://www.javatpoint.com/web-services-tutorial
17. https://www.javatpoint.com/soap-web-services,https://www.javatpoint.com/restful-web-services
18. RESTful Web Services - javatpoint
19. https://www.javatpoint.com/restful-web-services-spring-boot
20. https://www.javatpoint.com/restful-web-services-spring-

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

boothttps://dzone.com/articles/lifecycle-of-a-request-response-process-for-a-spri
21. https://www.ibm.com/docs/en/was/8.5.5?topic=applications-defining-uri-patterns-resources-in-restful
22. https://www.baeldung.com/exception-handling-for-rest-with-spring
23. https://howtodoinjava.com/spring-boot2/resttemplate/spring-restful-client-resttemplate-example/
24. https://www.javatpoint.com/restful-web-services-versioning
25. https://spring.io/guides/gs/rest-service-cors/
26. https://www.javatpoint.com/restful-web-services-basic-authentication-with-spring-security
27. https://www.springboottutorial.com/rest-api-best-practices-with-java-and-spring

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
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SECURE CODING TECHNIQUES (Job Oriented Course)					

Course Outcomes:
At the end of the Course, student will be able to:

- Differentiate the objectives of information security
- Understand the trend, reasons and impact of the recent Cyber attacks
- Understand OWASP design principles while designing a web application
- Understand Threat modelling
- Importance of security in all phases of SDLC
- Write secure coding using some of the practices in C/C++/Java and Python programming languages

UNIT I:
Network and Information security Fundamentals: Network Basics, Network Components, Network Types, Network Communication Types, Introduction to Networking Models, Cyber Security Objectives and Services, Other Terms of Cyber Security, Myths Around Cyber Security, Myths Around Cyber Security, Recent Cyber Attacks, Generic Conclusion about Attacks, Why and What is Cyber Security, Categories of Attack

UNIT II:
Introduction to Cyber security: Introduction to OWASP Top 10, A1 Injection, A1 Injection Risks Root Causes and its Mitigation, A1 Injection, A2 Broken Authentication and Session Management, A7 Cross Site Scripting XSS,A3 Sensitive Data Exposure, A5 Broken Access Control, A4 XML External Entity (XEE), A6 Security Misconfiguration, A7 Missing Function Level Access Control, A8 Cross Site Request Forgery CSRF, A8 Insecure Deserialization, A9 Using Components With Known Vulnerabilities, A10 Unvalidated Redirects and Forwards, A10 Insufficient Logging and Monitoring, Secure Coding Practices, Secure Design Principles, Threat Modelling, Microsoft SDL Tool

UNIT III:
Secure coding practices and OWASP Top 10: Declarative Security, Programmatic Security, Concurrency, Configuration, Cryptography, Input and Output Sanitization, Error Handling, Input Validation, Logging and auditing, Session Management, Exception Management, Safe APIs, Type Safety, Memory Management, Tokenizing, Sandboxing, Static and dynamic testing, vulnerability scanning and penetration testing

UNIT IV
Secure coding practices in C/C++ and Java: Potential Software Risks in C/C++, Defensive coding, Preventative Planning, Clean Code, Iterative Design, Assertions, Pre Post Conditions, Low level design inspections, Unit Tests
Java- Managing Denial of Service, Securing Information, Data Integrity, Accessibility and Extensibility, Securing Objects, Serialization Security

UNIT V
Secure coding in Python: Interactive Python Scripting, Python Variables, Conditionals, Loops, Functions, External Modules, File operations, Web requests

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

Text Books:

1. Networking Fundamentals, 2019 edition, Packt, Author: Gordon Davies
2. Principles of Information Security, Authors: Michael E. Whitman and Herbert J. Mattord, Course technology incorp.
3. CSSLP SECURE SOFTWARE LIFECYCLE PROFESSIONAL ALL-IN-ONE EXAM GUIDE, Third Edition, 3rd Edition, Authors: Wm. Arthur Conklin, Daniel Paul Shoemaker, Released February 2022,Publisher(s): McGraw-Hill,ISBN: 9781264258215
4. OCP Oracle Certified Professional Java SE 11 Programmer II Study Guide: Exam 1Z0-816 and Exam 1Z0-817 Paperback – 6 August 2020, Authors: Scott Selikoff , Jeanne Boyarsky
5. OWASP 2017 Handbook,

https://owasp.org/www-pdf-archive/OWASP_Top_10_2017_RC2_Final.pdf

Web Links:

Infosys Springboard courses

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01268375129606553635 4_shared/contents [Network Fundamentals]
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_3388902307073574000_shared/overview [Introduction to cybersecurity]
3. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_013501569657159680 9160 [Certified Secure Software Lifecycle Professional (CSSLP) 2019: Secure Coding Practices]
4. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_013501568992755712 9660 [OWASP Top 10: Web Application Security]
5. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_013501593040977920 13093 [Defensive coding fundamentals in C and C++]
6. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_013501591729692672 13125 [Java SE 11 Programmer II: Secure Coding in Java SE 11 Applications]
7. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013501581644931072 11192/overview [Security Programming: Python Scripting Essentials]

Web references:

1. https://www.stealthlabs.com/blog/infographic-top-15-cybersecurity-myths-vs-reality/
2. https://microage.ca/cybersecurity-layering-approach/
3. https://www.synopsys.com/glossary/what-is-threat-modeling.html#:~:text=Threat%20modeling%20is%20a%20structured,An%20abstraction%20of%20the%20system
4. https://www.microsoft.com/en-us/securityengineering/sdl/threatmodeling
5. https://www.checkpoint.com/cyber-hub/threat-prevention/what-is-sandboxing/
6. https://www.skillsoft.com/course/defensive-coding-fundamentals-for-cc-f44c02f9-1bcc-11e7-b15b-0242c0a80b07#:~:text=Defensive%20Programming%20is%20a%20methodology,%2C%20testing%2C%20and%20input%20validation.
7. https://www.oracle.com/java/technologies/javase/seccodeguide.html
8. https://www.skillsoft.com/course/security-programming-python-scripting-essentials-be99adad-1f65-47a8-a4b5-6b5346072b8e

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		3	0	0	3
UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY					

Human Values Courses
This course also discusses their role in their family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester forwhich the foundation course named as "H-102 Universal Human Values 2: Understanding Harmony"is designed which may be covered in their III or IV semester. During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

Universal Human Values 2: Understanding Harmony
Course code: HSMC (H-102)
Credits: L-T-P-C 2-1-0-3 or 2L:1T:0P 3 credits
Pre-requisites: None. Universal Human Values 1 (desirable)

1. Objective:
The objective of the course is four fold:
1. Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

2. Course Topics:
The course has 28 lectures and 14 practice sessions in 5 modules:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education
1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than asarbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!
7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensureSanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family**.**

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

3. READINGS:

3.1 Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

3.2 Reference Books

1. JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

4. MODE OF CONDUCT (L-T-P-C 2-1-0-3 or 2L:1T:0P 3 credits)

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
Tutorial hours are to be used for practice sessions.
While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials)
would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

5. ASSESSMENT:
This is a compulsory credit course. The assessment is to provide a fair state of development of thestudent, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.
Example:

Assessment by faculty mentor: 10 marks
Self-assessment: 10 marks
Assessment by peers: 10 marks
Socially relevant project/Group Activities/Assignments: 20 marks
Semester End Examination: 50 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course**.**

6. OUTCOME OF THE COURSE:
By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.
This is only an introductory foundational input. It would be desirable to follow it up by
a) faculty-student or mentor-mentee programs throughout their time with the institution
b) Higher level courses on human values in every aspect of living. E.g. as a professional

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		0	0	4	2
MACHINE LEARNING WITH GO (Skill Oriented Course)					

Course Objectives:

- To turn the students into a productive, innovative data analyst who can leverage Go to build robust and valuable applications.
- To introduce the technical aspects of building predictive models in Go, but also helps you understand how machine learning workflows are applied in real-world scenarios.
- To understand how to gather, organize, and parse real-work data from a variety of sources.
- To develop a solid statistical toolkit that will allow you to quickly understand gain intuition about the content of a dataset.
- To implement essential machine learning techniques (regression, classification, clustering, and so on) with the relevant Go packages.

Prerequisites:

1. Bash Shell
2. Go-an editor

List of Experiments:

1. a) Write a Go program to read CSV file and find the maximum value in a particular column.
   b) Write a Go program to read iris dataset which is in csv format and demonstrate handling of unexpected fields, types and manipulating CSV data.
2. a) Demonstrate how JSON data can be parsed using Go.
   b) Demonstrate how to connect and Querying SQL like databases (Postgres MySQL, SQL Lite) using Go
3. Demonstrate how to cache data in memory using Go
4. a) Demonstrate how to represent matrices and vectors in Go
   b) Write a Go program to get statistical measures like mean, median, standard deviation and so on for any dataset.
   c) Write a Go program to visualize data distributions using Histogram, Box Plots.
5. a) Write a Go program to demonstrate Mean Squared Error(MSE), Mean Absolute Error (MAE) , R^2 (R Squared).
   b) Write a Go program to compute Accuracy, Precision , Recall, AUC (Area Under Cover)
6. a) Demonstrate how to build a linear regression model using Go.
   b) Demonstrate how to build a multiple linear regression model using Go.
7. Demonstrate how to build a logistic regression model using Go
8. Apply k-nearest neighbor classifier on iris dataset using Go
9. Build a decision tree on iris dataset using Go.
10. Demonstrate K-Means clustering method using Go.
11. Build auto regressive models for time series data using Go
12. Demonstrate how to build a simple neural network using Go

References:

https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094429228687360238 3_shared/overview

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

IV B Tech I Sem		L	T	P	C
		0	0	4	2
MEAN STACK TECHNOLOGIES-MODULE II- ANGULAR JS AND MongoDB (Skill Oriented Course)					

Course Outcomes:

- Build a component-based application using Angular components and enhance their functionality using directives.
- Utilize data binding for developing Angular forms and bind them with model data.
- Apply Angular built-in or custom pipes to format the rendered data.
- Develop a single page application by using synchronous or asynchronous Angular routing.
- Make use of MongoDB queries to perform CRUD operations on document database.

List of Exercises:

1.a	**Course Name:** Angular JS
	Module Name: Angular Application Setup
	Observe the link http://localhost:4200/welcome on which the mCart application is running. Perform the below activities to understand the features of the application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24049616594198490000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
1.b	**Course Name:** Angular JS
	Module Name: Components and Modules
	Create a new component called hello and render Hello Angular on the page
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28217843279641040000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
1.c	**Course Name:** Angular JS
	Module Name: Elements of Template
	Add an event to the hello component template and when it is clicked, it should change the courseName.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_19226434057992030000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
1.d	**Course Name:** Angular JS
	Module Name: Change Detection
	progressively building the PoolCarz application
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_25609816371207710000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
2.a	**Course Name:** Angular JS
	Module Name: Structural Directives - ngIf
	Create a login form with username and password fields. If the user enters the correct credentials, it should render a "Welcome <<username>>" message otherwise it should render "Invalid Login!!! Please try again..." message
	https://infyspringboard.onwingspan.com/web/en/viewer/web-

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

	module/lex_auth_012763740226043904259 5_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
2.b	**Course Name:** Angular JS
	Module Name: ngFor
	Create a courses array and rendering it in the template using ngFor directive in a list format.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_32795774277593590000_shared?collectionId=lex_208585155432546000 00_shared&collectionType=Course
2.c	**Course Name:** Angular JS
	Module Name: ngSwitch
	Display the correct option based on the value passed to ngSwitch directive.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_23388127475984175000_shared?collectionId=lex_208585155432546000 00_shared&collectionType=Course
2.d	**Course Name:** Angular JS
	Module Name: Custom Structural Directive
	Create a custom structural directive called 'repeat' which should repeat the element given a number of times.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24073319904331424000_shared?collectionId=lex_208585155432546000 00_shared&collectionType=Course
3.a	**Course Name:** Angular JS
	Module Name: Attribute Directives - ngStyle
	Apply multiple CSS properties to a paragraph in a component using ngStyle.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24037156998765367000_shared?collectionId=lex_208585155432546000 00_shared&collectionType=Course
3.b	**Course Name:** Angular JS
	Module Name: ngClass
	Apply multiple CSS classes to the text using ngClass directive.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_34596102970741820 00_shared?collectionId=lex_2085851554325460000 0_shared&collectionType=Course
3.c	**Course Name:** Angular JS
	Module Name: Custom Attribute Directive
	Create an attribute directive called 'showMessage' which should display the given message in a paragraph when a user clicks on it and should change the text color to red.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_14783742359773809000_shared?collectionId=lex_208585155432546000 00_shared&collectionType=Course
4.a	**Course Name:** Angular JS
	Module Name: Property Binding
	Binding image with class property using property binding.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_89519647091536190 00_shared?collectionId=lex_2085851554325460000 0_shared&collectionType=Course

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

4.b	**Course Name:** Angular JS
	Module Name: Attribute Binding
	Binding colspan attribute of a table element to the class property.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_7154252883180625000_shared?collectionId=lex_2085851554325460000 0_shared&collectionType=Course
4.c	**Course Name:** Angular JS
	Module Name: Style and Event Binding
	Binding an element using inline style and user actions like entering text in input fields.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_7417401021103822000_shared?collectionId=lex_2085851554325460000 0_shared&collectionType=Course
5.a	**Course Name:** Angular JS
	Module Name: Built in Pipes
	Display the product code in lowercase and product name in uppercase using built-in pipes.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_11810543990912035000_shared?collectionId=lex_208585155432546000 00_shared&collectionType=Course
5.b	**Course Name:** Angular JS
	Module Name: Passing Parameters to Pipes
	Apply built-in pipes with parameters to display product details.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_21187073707540988000_shared?collectionId=lex_208585155432546000 00_shared&collectionType=Course
5.c	**Course Name:** Angular JS
	Module Name: Nested Components Basics
	Load CourseslistComponent in the root component when a user clicks on the View courses list button.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24231999287700136000_shared?collectionId=lex_208585155432546000 00_shared&collectionType=Course
6.a	**Course Name:** Angular JS
	Module Name: Passing data from Container Component to Child Component
	Create an AppComponent that displays a dropdown with a list of courses as values in it. Create another component called the CoursesList component and load it in AppComponent which should display the course details. When the user selects a course from the
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_15758356947336235000_shared?collectionId=lex_208585155432546000 00_shared&collectionType=Course
6.b	**Course Name:** Angular JS
	Module Name: Passing data from Child Component to ContainerComponent
	Create an AppComponent that loads another component called the CoursesList component. Create another component called CoursesListComponent which should display the courses list in a table along with a register .button in each row. When a user clicks on th
	https://infyspringboard.onwingspan.com/web/en/viewer/web-

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

	module/lex_2494980689916818400_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
6.c	**Course Name:** Angular JS
	Module Name: Shadow DOM
	Apply ShadowDOM and None encapsulation modes to components.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_10312243404892470000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
6.d	**Course Name:** Angular JS
	Module Name: Component Life Cycle
	Override component life-cycle hooks and logging the corresponding messages to understand the flow.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_10818939635948007000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
7.a	**Course Name:** Angular JS
	Module Name: Template Driven Forms
	Create a course registration form as a template-driven form.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_2810668513603024400_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
7.b	**Course Name:** Angular JS
	Module Name: Model Driven Forms or Reactive Forms
	Create an employee registration form as a reactive form.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_33704702617536004000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
7.c	**Course Name:** Angular JS
	Module Name: Custom Validators in Reactive Forms
	Create a custom validator for an email field in the employee registration form (reactive form)
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_33728128192769250000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
8.a	**Course Name:** Angular JS
	Module Name: Custom Validators in Template Driven forms
	Create a custom validator for the email field in the course registration form.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_27688491925133280000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
8.b	**Course Name:** Angular JS
	Module Name: Services Basics
	Create a Book Component which fetches book details like id, name and displays them on the page in a list format. Store the book details in an array and fetch the data using a custom service.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_32584403823635940000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

8.c	**Course Name:** Angular JS
	Module Name: RxJS Observables
	Create and use an observable in Angular.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_6209609363905256000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
9.a	**Course Name:** Angular JS
	Module Name: Server Communication using HttpClient
	Create an application for Server Communication using HttpClient
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012763739531706368261 5_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
9.b	**Course Name:** Angular JS
	Module Name: Communicating with different backend services using Angular HttpClient
	Create a custom service called ProductService in which Http class is used to fetch data stored in the JSON files.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_4266333361795059700_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
10. a	**Course Name:** Angular JS
	Module Name: Routing Basics, Router Links
	Create multiple components and add routing to provide navigation between them.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_3782024852517635000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
10. b	**Course Name:** Angular JS
	Module Name: Route Guards
	Considering the same example used for routing, add route guard to BooksComponent. Only after logging in, the user should be able to access BooksComponent. If the user tries to give the URL of Bookscomponent in another tab or window, or if the user tries
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_30303325731876470000_shared?collectionId=lex_208585155432546000000_shared&collectionType=Course
10. c	**Course Name:** Angular JS
	Module Name: Asynchronous Routing
	Apply lazy loading to BookComponent. If lazy loading is not added to the demo, it has loaded in 1.14 s. Observe the load time at the bottom of the browser console. Press F12 in the browser and click the Network tab and check the Load time
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_9878739890118246000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
10. d	**Course Name:** Angular JS
	Module Name: Nested Routes
	Implement Child Routes to a submodule.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012768043900444672140_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

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DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

11. a	**Course Name:** MongoDB Essentials - A Complete MongoDB Guide
	Module Name: Installing MongoDB on the local computer, Create MongoDB Atlas Cluster
	Install MongoDB and configure ATLAS
	https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01281821437313024030083_shared?collectionId=lex_auth_01317716929471283211 3_shared&collectionType=Course
11. b	**Course Name:** MongoDB Essentials - A Complete MongoDB Guide
	Module Name: Introduction to the CRUD Operations
	Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()
	https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01281821874166169630118_shared?collectionId=lex_auth_01317716929471283211 3_shared&collectionType=Course
12. a	**Course Name:** MongoDB Essentials - A Complete MongoDB Guide
	Module Name: Create and Delete Databases and Collections
	Write MongoDB queries to Create and drop databases and collections.
	https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01281821654119219230121_shared?collectionId=lex_auth_01317716929471283211 3_shared&collectionType=Course
12. b	**Course Name:** MongoDB Essentials - A Complete MongoDB Guide
	Module Name: Introduction to MongoDB Queries
	Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().
	https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01328908162645196825 05_shared?collectionId=lex_auth_01317716929471283211 3_shared&collectionType=Course

Text Books:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson.
2. Pro Mean Stack Development, 1st Edition, ELadElrom, Apress O'Reilly.
3. Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'Reilly Media.
4. MongoDB – The Definitive Guide, 2nd Edition, Kristina Chodorow, O'Reilly

Software configuration and installation:

1. Angular
   Setup details: Angular Application Setup - Internal - Viewer Page | Infosys Springboard (onwingspan.com)
2. MongoDB
   TOC - MongoDB Essentials - A Complete MongoDB Guide | Infosys Springboard (onwingspan.com)

Web Links:

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_20858515543254600000_shared/overview (Angular JS)
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01317716929471283211 3_shared/overview (MongoDB)

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IV B Tech I Sem	Minor	L	T	P	C
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REINFORCEMENT LEARNING					

Course Objective:

- Learn various approaches to solve decision problems with functional models and algorithms for task formulation, Tabular based solutions, Function approximation solutions, policy gradients and model based reinforcement learning.

Course Outcomes:

By completing the course the students will be able to:

- Understand basic concepts of Reinforcement learning
- Identifying appropriate learning tasks for Reinforcement learning techniques
- Understand various methods and applications of reinforcement learning

UNIT I:

Introduction: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe

Multi-armed Bandits: A k-armed Bandit Problem, Action-value methods, The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper – Confidence-Bound Action Selection, Gradient Bandit Algorithm

UNIT II:

Finite Markov Decision Process: The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notataion for Episodic and Continuing Tasks, Policies and Value Functions,

Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming

UNIT III:

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Discontinuing-aware Importance Sampling, Per-decision Importance Sampling

***n*-step Bootstrapping:** *n*-step TD Prediction, *n*-step Sarsa, *n*-step Off-policy Learning, Per-decision methods with Control Variables, A Unifying Algorithm: *n*-step Q(σ)

UNIT IV:

Off-policy Methods with Approximation: Semi-gradient Methods, Examples of Off-policy Divergence, The Deadly Triad, Linear Value-function Geometry, Gradient Descent in the Bellman Error, The Bellman Error is not Learnable, Gradient-TD methods, Emphatic-TD methods, Reducing Variance

Eligibility Traces: The λ-return, TD(λ), *n*-step Truncated λ-return methods, Online λ –return Algorithm, True Online TD(λ), Dutch Traces in Monte Carlo Learning, Sarsa(λ), Variable λ and γ, Off-policy Traces with Control Variables, Watkins's Q(λ) to Tree-Backup(λ)

UNIT V:

Policy Gradient Methods: Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFOECE: Monte Carlo Policy Gradient, REINFORCE with Baseline, Actor-Critic Methods, Policy Gradient for Continuing Problems, Policy Parameterization for Continuous Actions

Applications and Case Studies: TD-Gammon, Samuel's Checkers Player, Watson's Daily Double

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Wagering, Optimizing Memory Control, Personalized Web Services

Text Books:

1. R. S. Sutton and A. G. Bart,. "Reinforcement Learning - An Introduction," MIT Press, 2018.

References:

1. Szepesvári, Csaba, "Algorithms for Reinforcement Learning," United States: Morgan & Claypool, 2010.
2. Puterman, Martin L., "Markov Decision Processes: Discrete Stochastic Dynamic Programming," Germany: Wiley, 2014.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_cs74/preview
2. https://www.coursera.org/learn/fundamentals-of-reinforcement-learning