IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Scheme Based on AICTE Flexible Curriculum

Department of Computer Science & Engineering

Bachelor of Technology (B.Tech.) [Computer Science & Engineering]

VII Semester

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem	Mid Sem. Exam.	Quiz/ Assignment	End Sem	Term work / Lab Work & Sessional		L	T	P	
1.	**PCC-CS701**	PCC	**Data Science**	70	20	10	60	40	**200**	3	–	2	**4**
2.	**PEC-CS701**	PEC	**Elective-III**	70	20	10	60	40	**200**	3	–	2	**4**
3.	**PEC-CS702**	PEC	**Elective-IV**	70	20	10	–	–	**100**	3	–	–	**3**
4.	**OEC-CS701**	OEC	**Open Elective-III**	70	20	10	–	–	**100**	3	–	–	**3**
5.	**PROJ-CS701**	PROJ	**Project-II**	–	–	–	60	40	**100**	–	–	12	**6**
6.	**PROJ-CS702**	PROJ	**Evaluation of Internship-II**	–	–	–	60	40	**100**	–	–	4	**2**
		Total		**280**	**80**	**40**	**240**	**160**	**800**	**12**	**–**	**20**	**22**

Electives-III	**Electives-IV**	**Open Electives-III**
PEC-CS701(A) Mobile Application Development	PEC-CS702(A) Cloud Computing	OEC-CS701(A) Internet & Web Technology
PEC-CS701(B) Block Chain Technology	PEC-CS702(B) Pattern Recognition	OEC-CS701(B) Robotics
PEC-CS701(C) Soft Computing	PEC-CS702(C) Computational Intelligence	OEC-CS701(C) Embedded System
PEC-CS701(D) Semantic Web & Ontologies	PEC-CS702(D) Deep & Reinforcement Learning	OEC-CS701(D) Transportation Engineering

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	1 Credit	1 Credit

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VII-Semester

PCC-CS701	Data Science	3L : 0T: 0P (3 hrs.)	3 credits

Prerequisite: Basics of Statistics and Probability

Course Objective:

The objective of this course is to familiarize students with the roles of a data scientist and enable them to analyze data to derive meaningful information from it.

Course Contents: (40 hrs.)

Module 1: **(06 hrs.)**

Data Science and Big Data Overview: Types of data, Sources of data, Data collection, Data storage and management, Big Data Overview, Characterization of Big data, Drivers of Big Data, Challenges, Big Data Use Cases, Defining Big Data Analytics and examples of its use cases, Data Analytics Lifecycle: Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize.

Module 2: **(12 hrs.)**

Advanced Analytical Theory and Methods: Clustering, K-means, Additional Clustering Algorithms, Association Rules, Apriori Algorithm, Applications of Association Rules, Regression, Linear Regression, Logistic Regression, Classification, Decision Trees, Naive Bayes, Additional Classification Methods, Text Analysis, Text Analysis Steps, Determining Sentiments.

Module 3: **(10 hrs.)**

Advanced Analytics-Technology and Tools: Analytics for Unstructured Data Use Cases, MapReduce, Apache Hadoop, Traditional database vs. Hadoop, Hadoop Core Components, HDFS, Design of HDFS, HDFS Components, HDFS Architecture, Hadoop 2.0 Architecture, Hadoop-2.0 Resource Management, YARN.

Module 4: **(08 hrs.)**

The Hadoop Ecosystem: Introduction to Hive, HBase, Hive Use Cases: Face book, Healthcare; Hive Architecture, Hive Components. Integrating Data Sources, Dealing with Real-Time Data Streams, Complex Event Processing, Overview of Pig, Difference between Hive and Pig, Use

Cases of Pig, Pig program structure, Pig Components, Pig Execution, Pig data models, Overview of Mahout, Mahout working.

Module 5: **(04 hrs.)**

Introduction to R, Basic Data Analytics Methods Using R, Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables, Data Visualization Basics.

Course Outcome:

1. Demonstrate proficiency with statistical analysis of data.
2. Build and assess data-based models.
3. Execute statistical analyses with professional statistical software.
4. Demonstrate skill in data management.
5. Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

List of Text / Reference Books:

1. EMC Education Services, "Data Science and Big Data Analytics", Wiley, 2015.
2. Judith Hurwitz, Alan Nugent, Fern Halper, and Marcia Kaufman, "Big Data for Dummies", Wiley & Sons,2013.
3. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packt Publishing, 2013.
4. David Dietrich, Barry Heller, and Beibei Yang "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley & Sons, Inc.

List of Experiments:

1. Introduction to R tool for data analytics science
2. Basic Statistics and Visualization in R
3. K-means Clustering
4. Association Rules
5. Linear Regression
6. Logistic Regression
7. Naive Bayesian Classifier
8. Decision Trees
9. Simulate Principal component analysis
10. Simulate Singular Value Decomposition

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VII-Semester

PEC-CS701 (A)	**Mobile Application Development**	**3L : 0T: 2P (5 hrs.)**	**4 credits**

Prerequisite: JAVA Programming

Course Objective:

The objective of this course is to help students to gain a basic understanding of Android application development and tools.

Course Contents: (40 hrs.)

Module 1: **(10 hrs.)**
Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

Module 2: **(08 hrs.)**
Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

Module 3: **(06 hrs.)**
Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

Module 4: **(04 hrs.)**
Testing Android applications: Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

Module 5: **(12 hrs.)**
Using Common Android APIs: Using Android Data and Storage APIs, Managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Course Outcome:

1. Identify various concepts of mobile programming that make it unique from programming for other platforms.
2. Critique mobile applications on their design pros and cons.
3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
4. Program mobile applications for the Android operating system that use basic and advanced phone features.
5. Deploy applications to the Android marketplace for distribution.

List of Text / Reference Books:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
2. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
3. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd3.R3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

List of Experiments:

1. Compare various operating Systems with Android OS
2. Install / Configure JDK, Android studio and android SDK, ADT plug-in and create android Virtual device.

Develop a program:

3. To display "Hello world "on screen.
4. To implement linear layout, absolute layout.
5. To implement Frame layout, table layout and relative layout
6. To implement text view, edit view, auto complete text view.
7. To implement login window using above UI controls.
8. To implement Checkbox, Radio Button, and Radio group and progress bar.
9. To implement list view, Grid view, and Image view and scroll view.
10. To implement Date, time picker and activity

11 To implement Custom Toast Alert.

12. To build camera.
13. For providing Bluetooth connectivity.
13. For providing Bluetooth connectivity.
14. For animation.
15. To a) Send SMS b) Receiver SMS c) Send and receive E-mail.

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VII-Semester

PEC-CS701 (B)	Block Chain Technology	3L : 0T: 2P (5 hrs.)	4 credits

Prerequisite: NA

Course Objective:

To understand the concept of Blockchain and its platforms- Bitcoin, Ethereum, Hyperledger and Multichain. The course provides an overview of the structure and mechanism of Blockchain.

Course Contents: (40 hrs.)

Module 1: **(06 hrs.)**
Introduction and crypto foundation: Elliptic curve cryptography, ECDSA, Cryptographic hash function, SHA-256, Merkle trees, Cryptocurrencies.

Module 2: **(10 hrs.)**
Bitcoin, Bitcoin addresses, Bitcoin blockchain, block header, mining proof of work (PoW) algorithm, difficulty adjustment algorithm, mining pools, transactions, double spending attack, The 51% attacker, block format, transaction format, Smart contacts (escrow, micropayments, decentralized lotteries), payment channels.

Module 3: **(08 hrs.)**
Ethereum: Overview of differences between Ethereum and bitcoin, block format, mining algorithm, proof-of-stake (PoS) algorithm, account management, contracts and transactions, Solidity language, decentralized application using Ethereum.

Module 4: **(08 hrs.)**
Smart Contracts Different Blockchains and Consensus mechanisms.

Module 5: **(08 hrs.)**
Blockchain and Security R3, CORDA and Hyperledger System architecture, ledger format, chain code, transaction flow and ordering, private channels, membership service providers, case studies.

Course Outcome:

1. Understand blockchain architecture and requisite crypto foundation.
2. Understand various consensus protocol and their usage for their specific application.
3. Understand and Resolve security concern in blockchain.
4. Explore blockchain advances and upcoming platforms.
5. Learn to write smart contracts.

List of Text / Reference Books:

1. Mastering Bitcoin: Unblocking Digital Cryptocurrencies, by Andreas Antonopoulos.
2. Mastering Ethereum, Antonopoulos, Andreas M. and Wood, O'Reilly Media, Inc.,2018
3. An Introduction to Bitcoin, V. Saravanan, Lecture Notes.
4. Bitcoin and Cryptocurrencies Technologies: A Comprehensive Introduction, Arvind Narayanan, Princeton University Press (July 19,2016) ISBN-10:0691171696.

List of Experiments:

Write a program:

1. To Create a first block in blockchain
2. To encrypt a block using Sha 256 Encryption Algorithm
3. To Mine a Block in Blockchain
4. To authenticate a mined block using consensus algorithm'
5. To implement proof of work
6. To secure a block using encryption
7. To create a simple cryptocurrency
8. To write a smart contract in solidity

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VII-Semester

PEC-CS701 (C)	Soft Computing	3L : 0T: 2P (5 hrs.)	4 credits

Prerequisite: Analysis and Design of Algorithm

Course Objective:

The objective of this course is to familiarize the students with different soft computing tools to use them to be able to solve complex problems

Course Contents: (40 hrs.)

Module 1: **(08 hrs.)**
Introduction to Neural Network: Concept, biological neural network, comparison of ANN with biological NN, evolution of artificial neural network, Basic models, Types of learning, Linear separability, XOR problem, McCulloch-Pitts neuron model, Hebb rule.

Module 2: **(10 hrs.)**
Supervised Learning: Perceptron learning, Single layer/multilayer, Adaline, Madaline, Back propagation network, RBFN, Application of Neural network in forecasting, data compression and image compression.

Module 3: **(10 hrs.)**
Unsupervised learning: Introduction, Fixed weight competitive nets, Kohonen SOM, Counter Propagation networks, (Theory, Architecture, Flow Chart, Training Algorithm and applications). Introduction to Convolutional neural networks (CNN) and Recurrent neural networks (RNN).

Module 4: **(06 hrs.)**
Fuzzy Set: Introduction, Basic Definition and Terminology, Properties and Set-theoretic Operations, , Fuzzy Relations , Membership Functions and their assignment, Fuzzy rules and fuzzy Reasoning, Fuzzy if-then Rules, Fuzzy Inference Systems. Application of Fuzzy logic in solving engineering problems.

Module 5: **(06 hrs.)**
Genetic Algorithm: Introduction to GA, Simple Genetic Algorithm, terminology and operators of GA (individual, gene, fitness, population, data structure, encoding, selection, crossover, mutation, convergence criteria). Reasons for working of GA and Schema theorem, GA optimization

problems like TSP (Travelling salesman problem), Network design routing. Introduction to Ant Colony optimization (ACO) and Particle swarm optimization (PSO).

Course Outcome:

1. State basic concept of Neural Network
2. Illustrate various concepts supervised learning, data and image compression
3. Describe the concept of unsupervised learning.
4. Apply fuzzy logic concepts to solve real world problem.
5. Design and implement the real world problem through Genetic algorithm.

List of Text / Reference Books:

1. S.N. Shivnandam, “Principle of soft computing”, Wiley.
2. S. Rajshekaran and G.A.V. Pai, “Neural Network , Fuzzy logic And Genetic Algorithm”, PHI.
3. Jack M. Zurada, “Introduction to Artificial Neural Network System” JAico Publication.
4. Simon Haykins, “Neural Network- A Comprehensive Foundation”
5. Timothy J.Ross, “Fuzzy logic with Engineering Applications”, McGraw-Hills 1.

List of Experiments:

1. Form a perceptron net for basic logic gates with binary input and output.
2. Using Adaline net, generate XOR function with bipolar inputs and targets.
3. Calculation of new weights for a Back propagation network, given the values of input pattern, output pattern, target output, learning rate and activation function.
4. Design fuzzy inference system for a given problem.
5. Maximize the function y =3x2 + 2 for some given values of x using Genetic algorithm.
6. Implement Travelling salesman problem using Genetic Algorithm.
7. Optimisation of problem like Job shop scheduling using Genetic algorithm

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VII-Semester

PEC-CS701 (D)	**Semantic Web & Ontologies**	**3L : 0T: 2P (5 hrs.)**	**4 credits**

Prerequisite: NA

Course Objective:

The objective of this course is to familiarize the students about Semantic Web Vision and able to understand XML,RDF, Querying Ontology.

Course Contents: (40 hrs.)

Module 1: **(06 hrs.)**
Semantic Web: Building Models , Calculating with knowledge, Exchanging Information, Semantic Web Technologies ,Types of Web :Smart Web & Dumb Web, Applications ,Semantic Data ,Search Engine for Semantic Web

Module 2: **(08 hrs.)**
Semantic Modeling: Modeling for human communication, Explanation and prediction, Mediating Variability: Variation & Classes, Variation & Layers, Expressivity in Modeling.

Module 3: **(10 hrs.)**
Resource Description Language RDF : Introduction , Advanced features , simple ontologies in RDF Schema , encoding of special data structures, RDF formal semantics ,syntactic reasoning with deduction rules ,Distributing data across web , Managing data from multiple sources .

Module 4: **(10 hrs.)**
Web Ontology Language OWL : OWL syntax and Intuitive semantics , OWL species , Owl formal semantics : Description Logics , Model-Theoretic Semantics of OWL, Automated reasoning with OWL, Ontology Matching and Distributed Information .

Module 5: **(06 hrs.)**
Semantic Web Application Architecture: RDF Parser/Serializer, RDF store: RDF data standards and Interoperability of RDF stores , RDF query engines , SPARQL: Query language for RDF , conjunctive Queries for OWL DL ,RDF backed web portals , Data federation . Ontology

Engineering: Constructing Ontologies manually, Reusing Existing Ontologies, Semiautomatic Ontology Acquisition, Ontology Mapping

Course Outcome:

1.Understand the semantic web Vision and technologies
2.Understand about ontology
3.Understanding about Data Web (Linked open data Cloud)

List of Text / Reference Books:

1. Hitzler, Markus, Rudolph , " Foundations of Semantic Web Technologies" , Chapman & Hall/CRC,2009,ISBN 9781420090505
2. Allemang , Hendler , " Semantic Web for the working Ontologist" 2nd ed. Elsevier Pub
3. Liang Yu , " Introduction to the Semantic Web and Semantic Web Services", Chapman & Hall/CRC
4. Antoniou , Harmelen , "A semantic Web Primer", PHI Pub.
5. Rajendra Akerkar ," Foundations of Semantic Web" , Narosa Publishing ,NewDelhi

List of Experiments:

1. Working with XML
2. Working with XML Schema, DTD
3. Design of Ontology using RDF
4. Design RDF document with different Serialization format (e.g. tutle,N-triple)
5. Design of Ontology using RDFS
6. Design of Ontology using OWL
7. Case study : Pizza Ontology
8. Querying Ontology using SPARQL
9. Case Study : DBpedia
10. Case study : LOD Cloud

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VII-Semester

PEC-CS702 (A)	Cloud Computing	3L: 0T: 0P (3 hrs.)	3 credits

Prerequisite:

Course Objective:

The objective of this course is to provide students with the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications.

Course Contents: (40 hrs.)

Module 1: **(10 hrs.)**

Introduction of Grid and Cloud computing, characteristics, components, business and IT perspective, cloud services requirements, cloud models, Security in public model, public verses private clouds, Cloud computing platforms: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing.

Module 2: **(08 hrs.)**

Cloud services- SAAS, PAAS, IAAS, cloud design and implementation using SOA, conceptual cloud model, cloud stack, computing on demand, Information life cycle management, cloud analytics, information security, virtual desktop infrastructure, storage cloud.

Module 3: **(10 hrs.)**

Virtualization technology: Definition, benefits, sensor virtualization, HVM, study of hypervisor, logical partitioning- LPAR, Storage virtualization, SAN, NAS, cloud server virtualization, virtualized data center.

Module 4: **(06 hrs.)**

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control-Identity management, Access control, Autonomic Security, Cloud computing security challenges: Virtualization security

management- virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.

Module 5: **(06 hrs.)**

SOA and cloud, SOA and IAAS, cloud infrastructure benchmarks, OLAP, business intelligence, e-Business, ISV, Cloud performance monitoring commands, issues in cloud computing. QOS issues in cloud, mobile cloud computing, Inter cloud issues, Sky computing, Cloud Computing Platform, Xen Cloud Platform, Eucalyptus, OpenNebula, Nimbus, TPlatform, Apache Virtual Computing Lab (VCL), Anomaly Elastic Computing Platform.

Course Outcome:

1. Explain the core concepts of the cloud computing paradigm
2. Demonstrate knowledge of virtualization
3. Explain the core issues of cloud computing such as security, privacy, and interoperability.
4. Choose the appropriate technologies, algorithms, and approaches for the related issues.
5. Identify problems, and explain, analyze, and evaluate various cloud computing solutions.

List of Text / Reference Books:

1. Dr.Kumar Saurabh, “Cloud Computing”, Wiley India.
2. Ronald Krutz and Russell Dean Vines, “Cloud Security”, Wiley-India.
3. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, “Computing for Dummies”, Wiley India Edition.
4. Anthony T.Velte Toby J.Velte, “Cloud Computing – A Practical Approach”, TMH.
5. Barrie Sosinsky, ‘Cloud Computing Bible”, Wiley India.

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VII-Semester

PEC-CS702 (B)	Pattern Recognition	3L: 0T: 0P (3 hrs.)	3 credits

Prerequisite: NA

Course Objective:

The objective of this course is to learn the fundamentals of pattern recognition and its relevance to classical and modern problems.

Course Contents: (40 hrs.)

Module 1: **(08 hrs.)**

Introduction – Definitions, data sets for Pattern, Application Areas and Examples of pattern recognition, Design principles of pattern recognition system, Classification and clustering, supervised Learning, unsupervised learning and adaptation, Pattern recognition approaches, Decision Boundaries, Decision region , Metric spaces, distances.

Module 2: **(10 hrs.)**

Classification: introduction, application of classification, types of classification, decision tree, naïve Bayes, logistic regression , support vector machine, random forest, K Nearest Neighbor Classifier and variants, Efficient algorithms for nearest neighbor classification, Different Approaches to Prototype Selection, Combination of Classifiers, Training set, test set, standardization and normalization.

Module 3: **(10 hrs.)**

Different Paradigms of Pattern Recognition, Representations of Patterns and Classes, Unsupervised Learning & Clustering: Criterion functions for clustering, Clustering Techniques: Iterative square -error partitional clustering – K means, hierarchical clustering, Cluster validation.

Module 4: **(06 hrs.)**

Introduction of feature extraction and feature selection, types of feature extraction , Problem statement and Uses, Algorithms - Branch and bound algorithm, sequential forward / backward selection algorithms, (l, r) algorithm.

Module 5: **(06 hrs.)**

Recent advances in Pattern Recognition, Structural PR, SVMs, FCM, Soft computing and Neuro-fuzzy techniques, and real-life examples, Histograms rules, Density Estimation, Nearest Neighbor Rule, Fuzzy classification.

Course Outcome:

1. Understand the concept of a pattern and the basic approach to the development of pattern recognition
2. Acquire the knowledge of classification, its types and normalization.
3. Understand unsupervised learning & clustering in pattern recognition
4. Understand the basic methods of feature extraction, feature evaluation, and data mining
5. Understand soft computing and fuzzy classification for recent advancements in pattern recognition.

List of Text / Reference Books:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley,2006.
2. C.M. Bishop, "PatternRecognitionandMachineLearning",Springer,2009.
3. S. Theodoridis and. Koutroumbas, "Pattern Recognition", 4th Edition, academic Press,2009.
4. Robert Schalk off, "pattern Recognition: statistical, structural and neural approaches", JohnWiley&sons,Inc,2007.

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VII-Semester

PEC-CS702 (C)	**Computational Intelligence**	**3L: 0T: 0P (3 hrs.)**	**3 credits**

Prerequisite: NA

Course Objective:

The objective of this course is to provide a strong foundation on fundamental concepts in Computational Intelligence and its application.

Course Contents: (40 hrs.)

Module 1: **(06 hrs.)**
Introduction to Computational Intelligence; types of Computational Intelligence, components of Computational Intelligence. Concept of Learning/ Training model. Parametric Models, Nonparametric Models. Multilayer Networks: Feed Forward network, Feedback network.

Module 2: **(14 hrs.)**
Fuzzy Systems: Fuzzy set theory: Fuzzy sets and operations, Membership Functions, Concept of Fuzzy relations and their composition, Concept of Fuzzy Measures; Fuzzy Logic: Fuzzy Rules, Inferencing; Fuzzy Control - Selection of Membership Functions, Fuzzification, Rule Based Design & Inferencing, Defuzzyfication.

Module 3: **(08 hrs.)**
Genetic Algorithms: Basic Genetics, Concepts, Working Principle, Creation of Offsprings, Encoding, Fitness Function, Selection Functions, Genetic Operators-Reproduction, Crossover, Mutation; Genetic Modeling, Benefits.

Module 4: **(06 hrs.)**
Rough Set Theory - Introduction, Fundamental Concepts, Set approximation, Rough membership, Attributes, Optimization. Hidden Markov Models, Decision tree model.

Module 5: **(06 hrs.)**
Introduction to Swarm Intelligence, Swarm Intelligence Techniques: Ant Colony Optimization, Particle Swarm Optimization, Bee Colony Optimization etc. Applications of Computational Intelligence.

Course Outcome:

1. Describe in-depth about theories, methods, and algorithms in computation Intelligence.
2. Compare and contrast traditional algorithms with nature inspired algorithms.
3. Examine the nature of a problem at hand and determine whether a computation intelligent technique/algorithm can solve it efficiently enough.
4. Design and implement Computation Intelligence algorithms and approaches for solving real-life problems.

List of Text / Reference Books:

1. Russell C. Eberhart and Yuhui Shi, Computational Intelligence: Concepts to Implementations, Morgan Kaufmann Publishers.
2. Andries P. Engelbrecht, Computational Intelligence: An Introduction, Wiley Publishing. Simon Haykin, Neural Networks: A Comprehensive Foundation, Prentice Hall. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, Pearson Education.
3. Jagdish Chand Bansal, Pramod Kumar Singh, Nikhil R. Pal, Evolutionary and swarm Intelligence Algorithms, Springer Publishing, 2019.
4. S. Rajeskaran, G.A. Vijaylakshmi Pai, "Neural Networks, Fuzzy Logic, Genetic Algorithms Synthesis and Applications".
5. J.S. Roger Jang, C.T.Sun, E. Mizutani, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning & Machine Intelligence", PHI, 2002.

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VII-Semester

PEC-CS702 (D)	**Deep & Reinforcement Learning**	**3L: 0T: 0P (3 hrs.)**	**3 credits**

Prerequisite: Machine Learning

Course Objective:

The objective of this course is to learn designing and implementation of deep and reinforcement learning approaches using machine learning for solving real-life problems.

Course Contents: (40 hrs.)

Module 1: **(06 hrs.)**

History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Activation functions, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Ada Grad, RMS Prop, Adam, Eigenvalue Decomposition. Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models, Attention Mechanism, Attention overimages.

Module 2: **(10 hrs.)**

Autoencoders and relation to PCA, Regularization in autoencoders, Denoising auto encoders, Sparse autoencoders, Contractive autoencoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Batch Normalization, Instance Normalization, Group Normalization.

Module 3: **(10 hrs.)**

Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Learning Vectorial Representations Of Words, Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Recent Trends in Deep Learning Architectures.

Module 4: **(08 hrs.)**

Introduction to reinforcement learning(RL), Bandit algorithms – UCB, PAC, Median Elimination, Policy Gradient, Full RL & MDPs, Bellman Optimality, Dynamic Programming - Value iteration, Policy iteration, and Q-learning & Temporal Difference Methods, Temporal-Difference Learning, Eligibility Traces, Function Approximation, Least Squares Methods

Module 5: **(06 hrs.)**

Fitted Q, Deep Q-Learning , Advanced Q-learning algorithms , Learning policies by imitating optimal controllers , DQN & Policy Gradient, Policy Gradient Algorithms for Full RL, Hierarchical RL,POMDPs, Actor-Critic Method, Inverse reinforcement learning, Maximum Entropy Deep Inverse Reinforcement Learning, Generative Adversarial Imitation Learning, Recent Trends in RL Architectures.

Course Outcomes:

1. Describe in-depth about theories, models and algorithms in machine learning.
2. Compare and contrast different learning algorithms with parameters.
3. Examine the nature of a problem at hand and find the appropriate learning algorithms and it's parameters that can solve it efficiently enough.
4. Design and implement of deep and reinforcement learning approaches for solving real-life problems.

List of Text / Reference Books:

1. Deep Learning, An MIT Press book, Ian Goodfellow and YoshuaBengio and Aaron Courville
2. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.
3. Reinforcement Learning: An Introduction, Sutton and Barto, 2nd Edition.
4. Reinforcement Learning: State-of-the-Art, Marco Wiering and Martijn van Otterlo, Eds

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OEC-CS701 (A)	**Internet and Web Technology**	**3L: 0T: 0P (3 hrs.)**	**3 credits**

Prerequisite: NA

Course Objective:

The students will be able to Analyze a web page and identify its elements and attributes. Create web pages using XHTML and Cascading Style Sheets.

Course Contents: (40 hrs.)

Module 1: **(04 hrs.)**

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol : Request and Response, Web browser and Web servers, Features of Web 2.0 Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Web site, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation.

Module 2: **(08 hrs.)**

HTML :Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5

Module 3: **(14 hrs.)**

Style sheets : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3 JavaScript : Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, HTML : Combining HTML, CSS and JavaScript, Events and buttons

Module 4: **(04 hrs.)**

XML : Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT PHP: Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP

Module 5: **(10 hrs.)**

PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database bugs, Introduction of Bootstrap and jQuery

Course Outcome:

1. Describe the concepts of WWW including browser and HTTP protocol.
2. ListthevariousHTMLtagsandusethemtodeveloptheuserfriendlywebpages.
3. Define the CSS with its types and use them to provide the styles to the web pages at various levels.
4. Develop the modern web pages using the XML, HTML, CSS along with php as Per need of applications.
5. Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.

List of Text / Reference Books:

1. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India
2. Web Technologies, Black Book, dreamtech Press
3. HTML 5, Black Book, dreamtech Press
4. Web Design, Joel Sklar, Cengage Learning
5. Developing Web Applications in PHP and AJAX, Harwani, McGraw Hill
6. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson

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VII-Semester

OEC-CS701 (B)	ROBOTICS	3L: 0T: 0P (3 hrs.)	3 credits

Prerequisite: NA

Course Objective:

To understand the basic concepts associated with the design and Functioning and applications of Robots. To study about the drives and sensors used in Robots.

Course Contents: (40 hrs.)

Module 1: **(06 hrs.)**

Fundamentals of Robot: Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Functions – Need for Robots – Different Applications

Module 2: **(12 hrs.)**

Robot Drive Systems and End Effectors : Pneumatic Drives , Hydraulic Drives, Mechanical Drives, Electrical Drives, D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

Module 3: **(14 hrs.)**

Sensors and Machine Vision: Requirements of a sensor, Principles and Applications of the following types of sensors– Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors),Touch Sensors, (Binary Sensors, Analogue Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis –Data Reduction: Edge detection, Feature Extraction and Object Recognition -Algorithms. Applications– Inspection, Identification, Visual Serving and Navigation.

Module 4: **(04 hrs.)**

Robot Kinematics and Robot Programming: Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

Module 5: **(04 hrs.)**

Implementation and Robot Economics: RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

Course Outcome:

1. Learn about knowledge for the design of robotics.
2 Learn about force and torque sensing
3. Understand different sensors and vision of machine
4. Understand robot kinematics and robot programming
5. Apply basics on an application of Robots

List of Text / Reference Books:

1. M. P. Groover, “Industrial Robotics – Technology, Programming and Applications”, McGraw- Hill, 2001.
2. Saha S. , Introduction to Robotics , TMH.
3. Ghoshal Ashitava, Robotics, Fundamental Concepts and Analysis, Oxford.
4. Yu Kozyhev, Industrial Robots Handbook, MIR Publications.

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VII-Semester

OEC-CS701 (C)	Embedded Systems	3L: 0T: 0P (3 hrs.)	3 credits

Prerequisite: NA

Course Objectives:

The objective of this course is to introduce students with knowledge about the basic functions and applications of embedded systems, its protocols and softwares

Course Contents: (40 hrs.)

Module 1: **(06 hrs.)**

Introduction to Embedded Systems: Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, classification, major application areas, purpose of embedded systems, characteristics and quality attributes of embedded systems, common design metrics, and processor technology: general purpose processor, application specific processor, single purpose processor.

Module 2: **(08 hrs.)**

Embedded System Architecture: Von Neumann v/s Harvard architecture, instruction set architecture, CISC and RISC instructions set architecture, basic embedded processor, microcontroller architecture, CISC & RISC examples: 8051, ARM, DSP processors.

Module 3: **(08 hrs.)**

Input Output and Peripheral Devices Timers and counters, watchdog timers, interrupt controllers, PWM, keyboard controller, analog to digital converters, real time clock. Introduction to communication protocols: basic terminologies, concepts, serial protocol: I2C, CAN, firewire, USB. Parallel protocols: PCI bus, IrDA, bluetooth, IEEE 802.11, wireless protocols.

Module 4: **(10 hrs.)**

Memory System Architecture Caches, virtual memory, MMU, address translation, memory and interfacing , memory write ability and storage performance. Memory types, composing memory – advance RAM interfacing, microprocessor interfacing I/O addressing, interrupts, direct memory access, arbitration multilevel bus architecture.

Module 5: **(08 hrs.)**

Embedded System Supporting Technologies Difference between normal OS and RTOS, scheduling algorithms. Case study: Tiny OS, VxWorks, QNX. Overview of VLSI technology, introduction to device drivers. Case studies: washing machine, air-conditioning, auto focus camera.

Course Outcomes:

1. Explain the embedded system concepts and architecture of embedded systems.
2. Describe the architecture of 8051 microcontroller and write embedded program for 8051 microcontroller.
3. Select elements for an embedded systems tool.
4. Understand the memory types used in embedded systems.
5. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

List of Text / Reference Books:

1. F Vahid, T Giogarvis, Embedded systems: A unified hardware/software approach, Wiley, 1999.
2. Raj Kamal, Embedded Systems Introduction, 2nd Ed., TMH publication, 2015.
3. David E Simons, An Embedded Software Primer, Pearson, 1999.