St. Martin's Engineering College

UGC Autonomous
NBA & NAAC A+ Accredited
Dhulapally, Secunderabad-500100
www.smec.ac.in

B. TECH MINOR IN AIML

S.No.	Year/ Semester	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
				L	T	P		Internal (CIE)	External (SEE)	Total
1	III-I	CSM508PC	Foundations of Artificial Intelligence	3	0	0	3	30	70	100
2		CSM510PC	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
3	III-II	CSM608PC	Artificial Intelligence Applications	4	0	0	4	30	70	100
4	IV-I	CSM717PC	(Either online through MOOCS or off-line Class) Machine Learning **OR** Deep Learning	3	0	0	3	30	70	100
		CSM716PC								
5		CSM718PC	(The corresponding Laboratory) Machine Learning Lab **OR** Deep Learning Lab	0	0	3	1.5	30	70	100
		CSM707PC								
6	IV-II		**Any one of the following subjects:**	3	0	0	3	30	70	100
		CSM805PE	Robotics Process Automation							
		CSM806PE	Natural Language Processing							
		CSM807PE	Game theory							
		CSM809PE	Computer Vision and Robotics							
		CSM810PE	Speech and Video Processing							
		CSM808PE	Soft Computing							
7		CSM803PC	Mini Project	0	0	3	2	--	100	100
			Total	13	0	9	**18**	**180**	**420**	**700**

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FOUNDATIONS OF ARTIFICIAL INTELLIGENCE

III YEAR-I SEMESTER

Course Code	Programme	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
CSM508PC	Minor	3	0	0	3	30	70	100

COURSEOBJECTIVES

This course will enable students to

1. To review and strengthen important mathematical concepts required for AI&ML.
2. Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

COURSEOUTCOMES

1. After completion of course, students would be able to:
2. Design and implement machine learning solutions to classification, regression and clustering problems.
3. Evaluate and interpret the results of the different ML techniques.
4. Design and implement various machine learning algorithms in arrange of Real-world applications.

UNIT-I	DEFINING ARTIFICIAL INTELLIGENCE	Classes:12

Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming

UNIT-II	MATHEMATICAL FOUNDATIONS	Classes:12

Mathematical foundations: Matrix Theory and Statistics for Machine Learning. Idea of Machines learning from data, Classification of problem–Regression and Classification, Supervised and Unsupervised learning.

UNIT-III	LINEAR REGRESSION	Classes:12

Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.

UNIT-IV	LOGISTIC REGRESSION	Classes:12

Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (Onevs All), Problem of Over fitting.

UNIT-V	CLUSTERING ALGORITHMS	Classes:12

Discussion on clustering algorithms and use-cases centered around clustering and classification.

TEXT BOOKS

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning,1st Edition2011.
2. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.

REFERENCE BOOKS

1. AninditaDasBhattacharjee,"PracticalWorkbookArtificialIntelligenceand Soft Computing for beginners, Shroff Publisher-X team Publisher.
2. Tom Mitchell, Machine Learning, McGraw Hill,2017.
3. Christopher M.Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
4. T.Hastie, R.Tibshirani, J.Friedman.The Elements of Statistical Learning,2e,2011.

WEB REFERENCES

1. Artificial Intelligence, https://swayam.gov.in/nd2_cec20_cs10/preview.

ARTIFICIAL INTELLIGENCE LAB

III YEAR-I SEMESTER

Course Code	Programme	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
CSM510PC	Minor	0	0	3	1.5	30	70	100

LIST OF EXPERIMENTS

1. BasicprogramsinPythontogetfamiliarizevariousprogrammingstructures.
2. Implementation of logical rules in Python.
3. Using any data apply the concept of:
   a. Liner regression
   b. Gradient decent
   c. Logistic regression
4. Perform and plot over fitting in a dataset.
5. Implementation of KNN classification algorithm.
6. Implementation of k-means clustering algorithm.
7. Explore statistical methods for machine learning.

TEXT BOOKS

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning,1st Edition2011.
2. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.

REFERENCE BOOKS

1. AninditaDasBhattacharjee,"PracticalWorkbookArtificialIntelligenceand Soft Computing for beginners, Shroff Publisher-X team Publisher.
2. Tom Mitchell, Machine Learning, McGraw Hill,2017.
3. Christopher M.Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
4. T.Hastie, R.Tibshirani, J.Friedman.The Elements of Statistical Learning,2e,2011.

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Artificial Intelligence, https://swayam.gov.in/nd2_cec20_cs10/preview.

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AI APPLICATIONS

III YEAR-II SEMESTER								
Course Code	**Programme**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
CSM608PC	**Minor**	**4**	**0**	**0**	**4**	**30**	**70**	**100**

COURSE OBJECTIVES

To give deep knowledge of AI and how AI can be applied in various fields to make the life easy.

COURSE OUTCOMES

After completion of course, students would be able to:

1. To correlate the AI and solutions to modern problem.
2. To decide when to use which type of AI technique.

UNIT-I		Classes:12
Linguistic aspects of natural language processing, A.I. And Quantum Computing, Applications of Artificial Intelligence (AI) in business.		
UNIT-II		**Classes:12**
Emotion Recognition using human face and body language, AI based system to predict the diseases early, Smart Investment analysis, AI in Sales and Customer Support.		
UNIT-III		**Classes:12**
Robotic Processes Automation for supply chain management.		
UNIT-IV		**Classes:12**
AI-Optimized Hardware, Digital Twin i.e. AI Modeling, Information Technology &Security using AI.		
UNIT-V		**Classes:12**
Recent Topics in AI/ML: AI/ML in Smart solutions, AI/ML in Social Problems handling, Block chain and AI.		

TEXT BOOKS

1. Sameer Dhanrajani, AI and Analytics, Accelerating Business Decisions, John Wiley & Sons.
2. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley.

REFERENCE BOOKS

1. Life3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark, 2018.
2. Homo Deus: A Brief History of Tomorrow by Yuval Noah Harari, 2017.

MACHINE LEARNING

IVYEAR-I SEMESTER								
Course Code	**Programme**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
CSM717PC	**Minor**	**3**	**0**	**0**	**3**	**30**	**70**	**100**

PREREQUISITES

1. Data Structures
2. Knowledge on statistical methods

COURSE OBJECTIVES

1. This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
2. To understand computational learning theory.
3. To study the pattern comparison techniques.

COURSEOUTCOMES

After completion of course, students would be able to:

1. Understand the concepts of computational intelligence like machine learning
2. Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
3. Understand the Neural Networks and its usage in machine learning application.

UNIT-I	INTRODUCTION	Classes:12

Introduction-Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning, Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

Decision Tree Learning–Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT-II	ARTIFICIAL NEURAL NETWORKS	Classes:12

Artificial Neural Networks-1–Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks-2 – Remarks on the Back – Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, compares learning algorithms.

UNIT-III	BAYES IANLEARNING	Classes:12

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

Instance - Based Learning- Introduction, k-nearest neighbor algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT-IV	GENETIC ALGORITHMS	Classes:12

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

Reinforcement Learning – Introduction, the learning task, Q–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT-V	ANALYTICAL LEARNING	Classes:12

Analytical Learning – 1 - Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

Analytical Learning-2-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

TEXT BOOKS

1. Machine Learning–Tom M. Mitchell,- MGH.

REFERENCE BOOKS

1. Machine Learning: An Algorithmic Perspective, Stephen Marshl and, Taylor & Francis.

DEEP LEARNING

IV YEAR-I SEMESTER								
Course Code	**Programme**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
CSM716PC	**Minor**	**3**	**0**	**0**	**3**	**30**	**70**	**100**

COURSE OBJECTIVES

Students will be able to

1. To understand complexity of Deep Learning algorithms and their limitations.
2. To be capable of performing experiments in Deep Learning using real-world data.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Implement deep learning algorithms, understand neural networks and traverse the layers of data
2. Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces
3. Understand applications of Deep Learning to Computer Vision
4. Understand and analyze Applications of Deep Learning to NLP

UNIT-I	INTRODUCTION	Classes:12

Introduction: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. Rel U Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout

UNIT-II	CONVOLUTIONAL NEURAL NETWORKS	Classes:12

Convolutional Neural Networks: Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks,
Auto-encoder and DBM Attention and memory models, Dynamic Memory Models

UNIT-III	APPLICATIONS OF DEEP LEARNING TO COMPUTER VISION	Classes:12

Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks

UNIT-IV	APPLICATIONS OF DEEP LEARNING TO NLP	Classes:12

Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity.

UNIT-V	ANALOGY REASONING	Classes:12

Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs

TEXT BOOKS

1. Deep Learning by I an Good fellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

REFERENCEBOOKS

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub. G.H., and Van Loan C.F., Matrix Computations, JHU Press, 2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

MACHINE LEARING LAB

IV YEAR-I SEMESTER

Course Code	Programme	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
CSM718PC	Minor	0	0	3	1.5	30	70	100

COURSE OBJECTIVES

1. The objective of this lab is to get an over view of the various machine learning Techniques and can demonstrate them using python.

COURSE OUTCOMES

1. After the completion of the course the student can able to:
2. Understand complexity of Machine Learning algorithms and their limitations;
3. Understand modern notions in data analysis-oriented computing;
4. Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
5. Be capable of performing experiments in Machine Learning using real-world data

LIST OF EXPERIMENTS

1. The probability that it is Friday and that a student is absent is 3%.Since there are 5 school days in a week, the probability that it is Friday is 20%.What is the Probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%)

2. Extract the data from database using python

3. Implement k-nearest neighbors classification using python

4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means(i.e.,3 centroids)

VAR1	VAR2	CLASS
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1

0.773 0.186 1

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.
Medium skiing design single twenties no->high Risk
high golf trading married forties yes -> low Risk
low speedway transport married thirties yes -> med Risk
medium football banking single thirties yes->low Risk high
flying media married fifties yes -> high Risk
low football security single twenties no -> med Risk
medium golf media single thirties yes -> med Risk
medium golf transport married forties yes->low Risk
high skiing banking single thirties yes -> high Risk
low golf unemployed married forties yes->high Risk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `med Risk' in the dataset?

6. Implement linear regression using python.

7. Implement Naïve Bayes theorem to classify the English text

8. Implement an algorithm to demonstrate the significance of genetic algorithm

9. Implement the finite words classification system using Back-propagation algorithm

TEXT BOOKS

1. Machine Learning– Tom M. Mitchell, -MGH.

REFERENCE BOOKS

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.

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DEEP LEARING LAB

IV YEAR-I SEMESTER

Course Code	Programme	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
CSM707PC	Minor	0	0	3	1.5	30	70	100

COURSE OBJECTIVES

1. To Build the Foundation of Deep Learning.
2. To Understand How to Build the Neural Network.
3. To enable students to develop successful machine learning concepts.

COURSE OUTCOMES

1. Upon the Successful Completion of the Course, the Students would be able to:
2. Learn the Fundamental Principles of Deep Learning.
3. Identify the Deep Learning Algorithms for Various Types of Learning Tasks in various domains.
4. Implement Deep Learning Algorithms and Solve Real-world problems.

LIST OF EXPERIMENTS

1. Setting up the Spyder IDE Environment and Executing a Python Program
2. Installing Keras, Tensor flow and Pytorch libraries and making use of them
3. Applying the Convolution Neural Network on computer vision problems
4. ImageclassificationonMNISTdataset(CNNmodelwithFullyconnectedlayer)
5. Applying the Deep Learning Models in the field of Natural Language Processing
6. Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes
7. Applying the Auto encoder algorithms for en coding the real-world data
8. Applying Generative Adversial Networks for image generation and unsupervised tasks.

TEXT BOOKS

1. Deep Learning by I an Good fellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T.Hastie, R.Tibshirani, and J.Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N.Friedman, MIT Press.

REFERENCE BOOKS

1. Bishop C.M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub G.H., and Van Loan C. F., Matrix Computations, JHU Press, 2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata Mc Graw-Hill Education, 2004.

WEB REFERENCES

1. http://www.deeplearning.net
2. https://www.deeplearningbook.org/
3. https://developers.google.com/machine-learning/crash-course/ml-intro
4. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
5. http://neuralnetworksanddeeplearning.com/

ROBOTICS PROCESS AUTOMATION

IV YEAR-II SEMESTER								
Course Code	**Programme**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
CSM805PE	**Minor**	**3**	**0**	**0**	**3**	**30**	**70**	**100**

COURSE OBJECTIVES

Students will be able to:

To make learners familiar with the concepts of Robotic Process Automation.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Describe RPA, where it can be applied and how it's implemented.
2. Identify and understand Web Control Room and Client Introduction
3. Understand how to handle various devices and the workload
4. Understand Bot creators, Web recorders and task editors

UNIT-I		**Classes:12**

Introduction to Robotic Process Automation & Bot Creation Introduction to RPA and Use cases – Automation Any where Enterprise Platform – Advanced features and capabilities – Ways to create Bots

UNIT-II		**Classes:12**

Web Control Room and Client Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) – Features Panel–Activity (View Tasks in Progress and Scheduled Tasks) - Bots (View Bots Uploaded and Credentials)

UNIT-III		**Classes:12**

Devices (View Development and Run time Clients and Device Pools) – Work load (Queues and SLA Calculator) - Audit Log (View Activities Logged which are associated with Web CR) – Administration (Configure Settings, Users, Roles, License and Migration) –Demo of Exposed API's – Conclusion – Client introduction and Conclusion.

UNIT-IV		**Classes:12**

Bot Creator Introduction–Recorders–Smart Recorders–Web Recorders–Screen Recorders -Task Editor – Variables – Command Library – Loop Command – Excel Command–Database Command- String Operation Command - XML Command

UNIT-V		**Classes:12**

Terminal Emulator Command – PDF Integration Command – FTP Command – PGP Command Object Cloning Command – Error Handling Command – Manage Windows Control Command - Workflow Designer - Report Designer

TEXT BOOKS
1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – Ui Path: Create Software robots. With the leading RPA tool – Ui Path Kindle Edition.
REFERENCE BOOKS
1. Robotic Process Automation a Complete Guide-2020 Edition Kindle Edition.

NATURAL LANGUAGE PROCESSING

IV YEAR- II SEMESTER								
Course Code	**Programme**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
CSM806PE	**Minor**	**3**	**0**	**0**	**3**	**30**	**70**	**100**

PRE REQUISITES

Data Structure, Finite Automata and Probability Theory

COURSE OBJECTIVES

Students will be able to:

Introduction to some of the problems and solutions of NLP and the irrelation to linguistics and statistics.

COURSE OUTCOMES

After completion of course, students would be able to:

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

UNIT-I	FINDING THE STRUCTUREOFWORDS	Classes:12

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

UNIT-II	SYNTAX ANALYSIS	Classes:12

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

UNIT-III	SEMANTIC PARSING	Classes:12

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

UNIT-IV		Classes:12

Predicate-Argument Structure, Meaning Representation Systems, Software.

UNIT-V	DISCOURSE PROCESSING	Classes:12

Discourse Processing: Cohesion, Reference Resolution, Discourse Cohesion and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-SpecificModelingProblems,MultilingualandCrossLingualLanguage Modeling
TEXT BOOKS
1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication. 2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.
REFERENCE BOOKS
1. Speech and Natural Language Processing –Daniel Jurafsky & James H Martin, Pearson Publications.

GAME THEORY

IV YEAR- II SEMESTER								
Course Code	**Programme**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
CSM807PE	**Minor**	**3**	**0**	**0**	**3**	**30**	**70**	**100**

COURSE OBJECTIVES

Students will be able to:

The course will explain in depth the standard equilibrium concepts (suchasNash equilibrium, Sub game-Perfect Nash Equilibrium, and others) in Game Theory.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Understand the basic concepts of game theory and solutions.
2. Understand different types of equilibrium interpretations.
3. Understand and analyze knowledge and solution concepts.
4. Analyze extensive games with perfect information.

UNIT-I	FINDING THE STRUCTURE OF WORDS	Classes:12

Introduction- Game Theory, Games and Solutions Game Theory and the Theory of Competitive Equilibrium, Rational Behavior, The Steady State and Deductive Interpretations, Bounded Rationality Terminology and Notation.

Nash Equilibrium-Strategic Games, Nash Equilibrium Examples, Existence of a Nash Equilibrium, Strictly Competitive Games, Bayesian Games: Strategic Games with Imperfect Information.

UNIT-II	SYNTAX ANALYSIS	Classes:12

Mixed, Correlated, and Evolutionary Equilibrium - Mixed Strategy Nash Equilibrium, Interpretations of Mixed Strategy Nash Equilibrium, Correlated Equilibrium, Evolutionary Equilibrium, Rationalizability and Iterated Elimination of Dominated Actions-Rationalizability Iterated Elimination of Strictly Dominated Actions, Iterated Elimination of Weakly Dominated Actions.

UNIT-III	SEMANTIC PARSING	Classes:12

Knowledge and Equilibrium - A Model of Knowledge Common Knowledge, Can People Agree to Disagree? Knowledge and Solution Concepts, The Electronic Mail Game.

UNIT-IV		Classes:12

Extensive Games with Perfect Information – Extensive Games with Perfect Information

Sub game Perfect Equilibrium, Two Extensions of the Definition of a Game, The Interpretation of a Strategy, Two Notable Finite Horizon Games, Iterated Elimination of Weakly Dominated Strategies Bargaining Games Bargaining and Game Theory, A Bargaining Game of Alternating Offers Sub game Perfect Equilibrium Variations and Extensions.

UNIT-V	DISCOURSE PROCESSING	Classes:12

Repeated Games - The Basic Idea, Infinitely Repeated Games vs. Finitely Repeated Games. Infinitely Repeated Games: Definitions, Strategies as Machines, Trigger Strategies: Nash Folk Theorems Punishing for a Limited Length of Time: A Perfect Folk Theorem for the Limit of Means Criterion Punishing the Punisher: A Perfect Folk Theorem for the Overtaking Criterion Rewarding Players Who Punish: A Perfect Folk Theorem for the Discounting Criterion The Structure of Sub game Perfect Equilibria Under the Discounting Criterion Finitely Repeated Game.

TEXT BOOKS

1. A course in Game Theory, M.J. Osborne and A. Rubinstein, MIT Press.
2. Game Theory, Roger Myerson, Harvard University Press.
3. Game Theory, D. Fudenberg and J. Tirole, MIT Press.

REFERENCE BOOKS

1. Theory of Games and Economic Behavior, J. von Neumann and O. Morgenstern, New York: John Wiley and Sons.
2. Games and Decisions, R.D. Luce and H.Raiffa, New York: John Wiley and Sons.
3. Game Theory, G. Owen, 2nd Edition, New York: Academic Press.

COMPUTER VISION AND ROBOTICS

IV YEAR- II SEMESTER

Course Code	Programme	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
CSM809PE	Minor	3	0	0	3	30	70	100

PRE REQUISITES

UG level course in Linear Algebra and Probability.

COURSE OBJECTIVES

Students will be able to:

1. To understand the Fundamental Concepts Related To sources, shadows and shading.
2. To understand the Geometry of Multiple Views.

COURSEOUTCOMES

After completion of course, students would be able to:

1. Implement fundamental image processing techniques required for computer vision
2. Implement boundary tracking techniques
3. Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.
4. Apply 3 Division techniques and Implement motion related techniques.
5. Develop applications using computer vision techniques.

UNIT-I	CAMERAS	Classes:12

CAMERAS: Pinhole Cameras

Radiometry–Measuring Light: Light in Space, Light Surfaces, Important Special Cases.

Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Inter reflections: Global Shading Models.

Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT-II	LINEAR FILTERS, EDGE DETECTION & TEXTURE	Classes:12

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates.

Edge Detection: Noise, Estimating Derivatives, Detecting Edges.

Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT-III	STEREOPSIS & SEGMENTATION BY CLUSTERING	Classes:12

The Geometry of Multiple Views: Two Views

Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras. Segmentation by Clustering: What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering

UNIT-IV	SEGMENTATION	Classes:12

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness.

Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice.

Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.

UNIT-V	GEOMETRIC CAMERA MODELS	Classes:12

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetric, An Application: Mobile Robot Localization
Model-Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, and Application: Registration in Medical Imaging Systems, Curved Surfaces and Alignment.

TEXT BOOKS

1. David A. Forsyth and Jean Ponce: Computer Vision–A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCE BOOKS

1. E.R. Davies: Computer and Machine Vision –Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R.C. Gonzalez and R.E. Woods “Digital Image Processing” Addison Wesley 2008.
3. Richard Szeliski “Computer Vision: Algorithms and Applications” Springer-Verlag London Limited 2011.

SPEECH AND VIDEO PROCESSING

IV YEAR- II SEMESTER								
Course Code	**Programme**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
CSM810PE	**Minor**	**3**	**0**	**0**	**3**	**30**	**70**	**100**

COURSE OBJECTIVES

Knowledge on speech and video processing techniques

COURSE OUTCOMES

After completion of course, students would be able to:

1. Describe the mechanisms of human speech production systems and methods for speech feature extraction.
2. Understand basic algorithms of speech analysis and speech recognition.
3. Explain basic techniques in digital video processing, including imaging characteristics and sensors.
4. Apply motion estimation and object tracking algorithms on video sequence.

UNIT-I	SPEECH PROCESSING CONCEPTS	Classes:12

Speech processing concepts: The speech production mechanism, Discrete time speech signals, Pole-Zero modeling of speech, relevant properties of the fast Fourier transform for speech recognition, convolution, linear and nonlinear filter banks, spectral estimation of speech using DFT. Linear Prediction analysis of speech.

UNIT-II	SPEECH RECOGNITION	Classes:12

Speech recognition: Real and Complex Cepstrum, application of cepstral analysis to speech signal, feature extraction for speech, static and dynamic feature for speech recognition, robustness issues, discrimination in the feature space, feature selection, MFCC, LPCC, Distance measures, vector quantization models. Gaussian Mixture model, HMM.

UNIT-III	BASICS OF VIDEO PROCESSING	Classes:12

Basics of Video Processing: Video formation, perception and representation: Principle of color video, video cameras, video display, pinhole model, CAHV model, Camera motion, Shape model, motion model, Scene model, two-dimensional motion models. Three-Dimensional Rigid Motion, Approximation of projective mapping.

UNIT-IV	MOTION ESTIMATION TECHNIQUES	Classes:12

Motion estimation Techniques: Optical flow, motion representation, motion estimation criteria, optimization methods, pixel-based motion estimation, Block matching algorithm, gradient Based, Intensity matching, feature matching, frequency domain

Motion estimation, Depth from motion.Motion analysis applications: Video Summarization, video surveillance.

UNIT-V	OBJECT TRACKING AND SEGMENTATION	Classes:12

Object Tracking and Segmentation: 2D and 3D video tracking, blob tracking, kernel based counter tracking, feature matching, filtering Mosaicing, video segmentation, mean shift based, active shape model, video short boundary detection. Inter frame compression, Motion compensation.

TEXT BOOKS

1. Fundamentals of Speech recognition – L. Rabiner and B. Juang, Prentice Hall signal processing series.
2. Digital Video processing, A Murat Tekalp, Prentice Hall.
3. Discrete – time speech signal processing: principles and practice, Thomas F. Quatieri, Coth.
4. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang, Pearson Education.

REFERENCE BOOKS

1. "Speech and Audio Signal Processing", B. Gold and N. Morgan, Wiley.
2. "Digital image sequence processing, Compression, and analysis", Todd R. Reed, CRC Press.
3. "Hand book of Image and Video processing", AlBovik, Academic press, second Edition.

SOFT COMPUTING

IV YEAR- II SEMESTER								
Course Code	**Programme**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
CSM808PE	**Minor**	**3**	**0**	**0**	**3**	**30**	**70**	**100**

COURSE OBJECTIVES

1. Familiarize with soft computing concepts.
2. Introduce and use the idea of fuzzy logic and use of heuristics based on human experience.
3. Familiarize the Neuro-Fuzzy modeling using Classification and Clustering techniques.
4. Learn the concepts of Genetic algorithm and its applications.
5. Acquire the knowledge of Rough Sets.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Identify the difference between Conventional Artificial Intelligence to Computational Intelligence.
2. Understand fuzzy logic and reasoning to handle and solve engineering problems.
3. Apply the Classification and clustering techniques on various applications.
4. Understand the advanced neural networks and its applications.
5. Perform various operations of genetic algorithms, Rough Sets.
6. Comprehend various techniques to build model for various applications.

UNIT-I	INTRODUCTION TO SOFT COMPUTING	Classes:12

Introduction to Soft Computing: Evolutionary Computing, "Soft" computing versus "Hard" computing, Soft Computing Methods, Recent Trends in Soft Computing, Characteristics of Soft computing, Applications of Soft Computing Techniques.

UNIT-II	FUZZY SYSTEMS	Classes:12

Fuzzy Systems: Fuzzy Sets, Fuzzy Relations, Fuzzy Logic, Fuzzy Rule – Based Systems

UNIT-III		Classes:12

Fuzzy Decision Making, Particle Swarm Optimization

UNIT-IV	GENETIC ALGORITHMS	Classes:12

Genetic Algorithms: Basic Concepts, Basic Operators for Genetic Algorithms, Crossover and Mutation Properties, Genetic Algorithm Cycle, Fitness Function, Applications of Genetic Algorithm.

UNIT-V		Classes:12
Rough Sets, Rough Sets, Rule Induction, and Discernibility Matrix, Integration of Soft Computing Techniques.		

TEXT BOOKS

1.Soft Computing–Advances and Applications – Jan 2015 by B.K. Tripathy and J. Anuradha – Cengage Learning.

REFERENCE BOOKS

1. S.N. Sivanandam & S.N. Deepa, "Principles of Soft Computing", 2nd edition, Wiley India, 2008.
2. David E. Goldberg, "Genetic Algorithms – In Search, optimization and Machine learning", Pearson Education.
3. J.S.R. Jang, C.T. Sunand E. Mizutani, "Neuro – Fuzzy and Soft Computing", Pearson Education, 2004.
4. G.J. Klir & B. Yuan, "Fuzzy Sets & Fuzzy Logic", PHI, 1995.
5. Melanie Mitchell, "An Introduction to Genetic Algorithm", PHI,1998.
6. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Mc Graw - Hill International Editions, 1995.