An Autonomous Programme Structure of
M. Tech. Electronics and Telecommunication Engineering
Specialization: Artificial Intelligence
(AY: 2020-2021 Onwards)

M. Tech. E & TC –AI : First Semester										
Course Code	Course Title	Teaching Scheme Hours/Week			Examination Scheme				Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End Semester	Oral	Practical		
20ECAI 01	Mathematics for Artificial Intelligence	3	1	0	50	50	0	0	100	4
20ECAI 02	Optimization Techniques	3	1	0	50	50	0	0	100	4
20ECAI 03	Fundamentals of Artificial Intelligence	3	0	0	50	50	0	0	100	3
20ECAI 04	Machine Learning	3	0	0	50	50	0	0	100	3
20PEECAI 01	Programme Elective I	3	0	0	50	50	0	0	100	3
20ECAI 03L	Fundamentals of Artificial Intelligence Lab	0	0	2	0	0	25	0	25	1
20ECAI 04L	Machine Learning Lab	0	0	2	0	0	0	25	25	1
20PEECAI 01L	Programme Elective I Lab	0	0	2	0	0	25	0	25	1
Total		**15**	**2**	**6**	**250**	**250**	**50**	**25**	**575**	**20**
Grand Total		**23**			**575**				**575**	**20**

20PEECAI 01 Programme Elective I:

1. Digital Image Processing
2. Soft Computing

MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Dr. M. B. Khambete
Principal
MKSSS's Cummins College of Engineering For Women Karvenagar, Pune 411052.

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

M. Tech. E & TC –AI : Second Semester										
Course Code	Course Title	Teaching Scheme Hours /Week			Examination Scheme				Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End Semester	Oral	Practical		
20ECAI 05	Natural Language Processing	3	0	0	50	50	0	0	100	3
20ECAI 06	Data Analytics	3	0	0	50	50	0	0	100	3
20ECAI 07	AI in Wireless Communication	3	0	0	50	50	0	0	100	3
20ECAI 08	Deep Learning	3	0	0	50	50	0	0	100	3
20ECAI 09	Research Methodology	0	1	0	25	0	0	0	25	1
20PEECAI 02	Programme Elective II	3	0	0	50	50	0	0	100	3
20ECAI 05L	Natural Language Processing Lab	0	0	2	0	0	25	0	25	1
20ECAI 06L	Data Analytics Lab	0	0	2	0	0	25	0	25	1
20ECAI 08L	Deep Learning Lab	0	0	2	0	0	0	25	25	1
20AC 01	Audit Course*	0	0	2	0	0	0	0	0	0
Total		**15**	**1**	**8**	**275**	**250**	**50**	**25**	**600**	**19**
Grand Total		**24**			**600**				**600**	**19**

20PEECAI 02 Programme Elective II:

1. Computer Vision
2. Virtual Reality

***Audit Course:**

1. Soft Skills and Business Communications
2. Entrepreneurship Development

MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Dr. M. B. Khambete
Principal
MKSSS's Cummins College of Engineering For Women Karvenagar, Pune 411052.

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

M. Tech. E & TC –AI : Third Semester									
Course Code	Course Title	Teaching Scheme Hours /Week			Examination Scheme			Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End Semester	Oral		
20OEHS 01	Open Elective I (Online Course)	3	0	0	50	50	0	100	3
20PEECAI 03	Programme Elective III (Online Course)	3	0	0	50	50	0	100	3
20ECAI P1	Project Stage I	0	0	20	100	0	100	200	10
Total		**6**	**0**	**20**	**200**	**100**	**100**	**400**	**16**
Grand Total		**26**			**400**			**400**	**16**

20OEHS Elective I: NPTEL Online Courses under Humanity and Sciences approved by the Department (ISE and ESE will be conducted by the college) pertaining to the following domains

1. Ethics
2. Patent Law, Entrepreneurship
3. Foreign Language

20PEECAI 03 Programme Elective III: Online Courses

1. Reinforcement Learning
2. Applications of Artificial Intelligence

M. Tech. E & TC –AI : Fourth Semester									
Course Code	Course Title	Teaching Scheme Hours /Week			Examination Scheme			Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End semester	Oral		
20ECAI P2	Project Stage II	0	0	30	200	0	150	350	15
Total		**0**	**0**	**30**	**200**	**0**	**150**	**350**	**15**
Grand Total		**30**			**350**			**350**	**15**

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Dr. M. B. Khambete
Principal
MKSSS's Cummins College of Engineering For Women Karvenagar, Pune 411052.

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

20ECAI 01: Mathematics for Artificial Intelligence

Teaching Scheme:

Lectures: 3 Hrs/Week

Tutorial: 1 Hrs/Week

Examination Scheme:

In-Semester: **50**Marks

End-Semester: **50** Marks

Credits: 4

Course Objectives:

1. To interpret the types and operations on matrices and various methods of solving systems of linear equations
2. To recognize the concepts of vector space, linear independence, basis, dimension and its applications
3. To explore probability to analyze and test data
4. To explore statistical methods to analyze and test data
5. To learn multivariate calculus

Course Outcomes:

After completion of the course, students will be able to

1. Determine and analyze transformations of matrices and apply multiple methods to solve the systems of linear equations
2. Apply and analyze the concepts of vector space and subspace
3. Apply probability and Statistical methods for Data Analysis
4. Apply multivariate calculus to solve given problems

Unit I: Linear Algebra **(08)**

Scalars, Vectors, Matrices and Tensors, Rank of a matrix, use of echelon form and canonical form of a matrix to find rank, Inverse matrix to solve system of linear equations, Types of Matrices, classification of real and complex matrices, trace, quadratic form, Lower-Upper decomposition (LDU).

Unit II: Vector Spaces **(09)**

Vector Space, vector sub-space, basis and dimension, Linear dependence and independence of vectors, orthogonality, Orthogonal Projections, Gram-Schmidt orthogonalization Procedure, Eigen values and Eigen vectors, Principal Component Analysis (PCA), Singular Value Decomposition (SVD).

Unit III: Probability and Random Variables **(10)**

Probability, conditional probability, marginal probability, Bayes' theorem, Maximum Likelihood Estimation (MLE), Maximum A Posteriori estimation (MAP), Random variables, variance, expectation, Probability density function, histogram, Cumulative distribution function, standard probability density functions, probability distributions.

Unit IV: Multivariate Calculus **(09)**

Differential and Integral Calculus, Partial Differentiation, chain rule, Vector-Values Functions, Gradient, Jacobian and Hessian approach.

Reference Books:

1. Howard A, Chris R, **'Elementary Linear Algebra Applications Version'**, *Wiley-India,* (10^{th} Edition), (2016)
2. Gilbert Strang, '**Linear Algebra and its Applications**', 4th Ed., 2008 (10^{th} Indian reprint 2011), Cengage Learning
3. David C. Lay, '**Linear Algebra and Its Application**', *Pearson Education*, (3^{rd} Edition), (2002)
4. P. Z. Peebles, '**Probability, Random Variables and Random Signal Principles**', *Tata McGraw-Hill*, (4^{th} Edition), (2013)
5. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, '**Mathematics for Machine Learning**', *Cambridge University Press*, (1^{st} Edition), (2020)
6. Seymour Lipschutz, Marc Lars Lipson, '**Linear Algebra**', *Schaum's Outline, McGraw-Hill*, (4^{th} Edition)
7. S. M. Ross, '**Introduction to Probability and Statistics for Engineers and Scientists**', *Academic Press*, (3^{rd} Edition), (2005)

20ECAI 02 Optimization Techniques

Teaching Scheme:

Lectures: 3 Hrs/Week

Tutorial: 1 Hr/Week

Examination Scheme:

In-Semester: **50** Marks

End-Semester: **50** Marks

Credits: 4

Course Objectives:

1. To understand the basics of optimization techniques and problem formulation for optimization
2. To understand one-dimensional Optimization Algorithms
3. To understand solution techniques for unconstrained optimization problems with multiple variables
4. To understand linear programming to perform optimization
5. To understand Guided Random Search Methods and it's solution techniques based on random searches in locating the optima

Course Outcomes:

After completion of the course, students will be able to

1. Interpret the necessary and sufficient condition for optimization
2. Formulate the optimization problem
3. Solve optimization problems for various applications
4. Analyze solutions for optimization problems

UNIT I: Introduction (6)

Optimization Problem, Modeling of the Optimization Problem, Solution with the Graphical Method, Convexity, Gradient Vector, Directional Derivative, Hessian Matrix, Linear and Quadratic Approximations.

UNIT II:1-D Optimization Algorithms (7)

Introduction, Solution Techniques, Bisection Method, Newton–Raphson Method, Secant Method, Cubic Polynomial Fit, Golden Section Method.

UNIT III: Unconstrained Optimization (7)

Introduction, Unidirectional Search, Solution Techniques, Steepest Descent Method, Newton's Method, Modified Newton's Method, Levenberg–Marquardt Method, Powell Method.

UNIT IV: Linear Programming (7)

Introduction, Solution with the Graphical Method, Standard Form of an LPP, Basic Solution,

Simplex Method - Multiple Solutions, Degeneracy, Interior-Point Method, Portfolio Optimization.

UNIT V: Guided Random Search Methods **(9)**

Introduction, Genetic Algorithms - Initialize Population, Fitness Evaluation, Reproduction, Crossover and Mutation, Multimodal Test Functions, Particle Swarm Optimization, Ant Colony Optimization.

Reference Books:

1. Rajesh Kumar Arora, **'Optimization: Algorithms and Applications'**, *CRC Press Taylor & Francis Group, New York,* (1st Edition), (2015)
2. Rao.S.S., **'Engineering Optimization Theory and Practice'**, *A Wiley Interscience Publication, Canada*, (4th Edition), (2009)
3. Reklaitis, G.V., A. Ravindran, and K.M. Ragsdell, **'Engineering Optimization: Methods and Applications'**, *John Wiley, New York*, (2nd Edition), (2006)
4. Fletcher R., **'Practical method of optimization'**, *John Wiley, New York*,(2nd Edition), (2000)
5. Chong E.K.P. and Zal S. H., **'An Introduction to Optimization'**, *John Wiley, New York,* (2nd Edition), (2001)

MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Dr. M. B. Khambete
Principal
MKSSS's Cummins College of Engineering For Women Karvenagar, Pune 411052.

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

20ECAI 03 Fundamentals of Artificial Intelligence

Teaching Scheme
Lectures: 3 Hrs / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objective:

1. To explain the basics of Artificial Intelligence (AI)
2. To introduce various types of algorithms useful in AI
3. To explain the concepts of machine learning, pattern recognition and their applications in the field of AI
4. To explain the code of ethics for AI

Course Outcomes:

After completion of the course, students will be able to

1. Explain the components of intelligent agents and expert systems
2. Apply knowledge representation techniques and problem solving strategies to AI applications
3. Explain and analyze the search and learning algorithms
4. Describe the code of ethics for the AI systems

Unit I : Basics of AI **(04)**

Categories of AI, applications of AI, intelligent agents, agents and environments, good behavior, the nature of environments, structure of agents.

Unit II : Problem Solving and Constraint Satisfaction Problems **(07)**

Problem solving agents, searching for solutions, uninformed search strategies, Informed search strategies, heuristic function, local search algorithms and optimistic problems, optimal decisions in games, Alpha-Beta Pruning, Constraint satisfaction problems (CSP), Backtracking search and Local search for CSP.

Unit III : Knowledge Representation **(07)**

Logic, Propositional logic, First order logic, Knowledge engineering in first order logic, inference in first order logic, prepositional versus first order logic, forward chaining, backward chaining, resolution, knowledge representation, uncertainty and methods, Bayesian probability and belief network, probabilistic reasoning, Bayesian networks, inferences in Bayesian networks.

Unit IV : Learning **(06)**

Learning from observations: forms of learning, Inductive learning, Learning decision trees, Ensemble learning, Knowledge in learning, Logical formulation of learning, Explanation based learning, Learning using relevant information, Statistical learning methods, Learning with hidden variable, EM algorithm, Neural networks

Unit V : Expert Systems **(07)**

Introduction to Expert System, Architecture and functionality, Examples of Expert system, Basic steps of pattern recognition system, Feature Extraction- Principal Component Analysis, Linear Discriminant Analysis, Object Recognition- Template Matching theory, Prototype Matching Theory, Pattern Mining.

Unit VI: Code of Ethics for AI **(05)**

Privacy and Surveillance, Manipulation of Behavior, Opacity of AI Systems, Bias in Decision Systems, Human-Robot Interaction, Automation and Employment, Autonomous Systems, Machine Ethics, Artificial Moral Agents Privacy.

Reference Books:

1. Stuart Russell, Peter Norvig, **'Artificial Intelligence", A Modern Approach '**, *Pearson Education/Prentice Hall of India,* (3rd Edition), (2010)
2. Elaine Rich, Kevin Knight and Shivshankar Nair, **'Artificial Intelligence'**, *Tata McGraw Hill,* (3rd Edition), (2009)
3. Paula Boddington, **'Towards a Code of Ethics for Artificial Intelligence'**, *Springer international Publishing*, (1st Edition), (2017)
4. Nils J. Nilsson, **'Artificial Intelligence: A new Synthesis'**, *Morgan Kaufmann Publishers,* (1st Edition) (1998)
5. George F. Luger, **'Artificial Intelligence: Structures and Strategies for Complex Problem Solving '**, *Pearson Education,* (6th Edition), (2008)
6. _NPTEL Lectures on AI : http://nptel.ac.in/courses/106105077/
7. https://plato.stanford.edu/entries/ethics-ai/
8. https://intelligence.org/files/EthicsofAI.pdf
9. https://www.europarl.europa.eu/RegData/etudes/STUD/2020/634452/EPRS_STU(2020)634452_EN.pdf

20ECAI 04 Machine Learning

Teaching Scheme:

Lectures: 3 Hrs./Week

Examination Scheme:

In-Semester: 50Marks

End-Semester: 50 Marks

Credits: 3

Course Objectives:

1. To learn machine learning paradigms used for regression and classification
2. To analyze various machine learning algorithms
3. To use software tools for implementation of machine learning algorithms

Course Outcomes:

After completion of the course, students will be able to

1. Make use of the software tools to process data
2. Apply suitable data pre-processing and data visualization method to interpret data and select suitable features
3. Compare and contrast different supervised and unsupervised machine learning techniques with their advantages and limitations
4. Select a suitable classifier to build classification and recognition system
5. Apply various dimensionality reduction methods to extract important features from the input data
6. Analyze various machine learning techniques and design models for prediction, classification and clustering problems

Unit I: Foundations of Machine Learning **(07)**

Machine Learning Problem, Designing a learning system, Examples of Machine Learning, Machine Learning Applications across different industries, Types of machine learning. Basic concepts in machine learning- parametric and non-parametric methods, Overfitting and Underfitting, Bias and Variance, Optimization and Cost function, Performance measures, Tools for ML, Python essentials- Python Editors, Primitive Data types, Data structures, Numpy, Scipy, Pandas, Matplotlib, Scikit-learn.

Unit II: Data Interpretation **(10)**

Machine learning pipeline, Feature Engineering for ML, Data types- numerical and categorical, Data wrangling- filtering, pre-processing, typecasting, transformation, feature selection, Data visualization- Descriptive statistics, Frequency tables, Creating graphs, Data analysis- Univariate and Bivariate analysis, Statistical methods- Central tendencies and variance, Boxplot, Outliers.

Unit III: Supervised Learning **(10)**

Two-class and Multiclass learning problems, Regression- linear and logistic, Model selection and generalization, Outlier detection, Cross Validation, Classification, K-Nearest Neighbour algorithm, Support Vector Machines, Decision trees, Random Forests, Naïve Bayes classifier, Neural Networks, Applications of ML in Classification.

Unit IV: Unsupervised Learning **(09)**

Dimensionality reduction- Principal Component Analysis (PCA), Independent Component Analysis (ICA), Singular Value Decomposition (SVD), Clustering: k-Means, Mean-shift, Hierarchical Clustering, Expectation–Maximization (EM), Gaussian Mixture Models (GMM), Applications of ML in Clustering, Predictive analysis.

Reference Books:

1. Tom Mitchell, **'Machine Learning'**, *McGraw Hill Education Ltd.*, Ed.,(1st Edition), (2013)
2. Ethem Alpaydin, **'Introduction to Machine Learning'**, *MIT Press*, (2nd Edition), (2010)
3. Christopher Bishop, '**Pattern Recognition and Machine Learning**', *Springer*, (1st Edition), (2007)
4. Kevin Murphy, **'Machine Learning: A Probabilistic Perspective'**, *MIT Press*, (1st Edition), (2012)
5. Andreas C. Miiller and Sarah Guido, **'Introduction to Machine Learning with Python- A Guide for Data Scientists'**, *O'Reilly Media, Inc.*, (1st Edition), (2017)
6. Chris Albon, **'Machine Learning with Python Cookbook'**, *O'Reilly Media*, Inc., (1st Edition), (2018)
7. Michael Bowles, **'Machine Learning in Python: Essential Techniques for Predictive Analysis'**, *John Wiley & Sons*, Inc., (1st Edition), (2015)

MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Dr. M. B. Khambete
Principal
MKSSS's Cummins College of Engineering For Women Karvenagar, Pune 411052

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

20PEECAI 01 Digital Image Processing

Teaching Scheme:

Lectures: 3 Hrs /Week

Examination Scheme:

In-Semester: **50** Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To understand image fundamentals and mathematical operations performed on images
2. To learn image enhancement techniques
3. To understand different image segmentation techniques
4. To study image Representation and Description techniques
5. To study applications of image processing amd AI applications of Image Processing

Course Outcomes:

After completion of the course, students will be able to

1. Describe image processing fundamentals and implement basic mathematical operations on digital images
2. Apply image enhancement techniques in spatial and frequency domain
3. Implement segmentation techniques
4. Implement and analyze feature extraction and feature description techniques
5. Apply image processing and AI techniques to develop different applications

Unit I: Digital Image Fundamentals **(03)**

Elements of visual perception, Human Visual system, Image sensing and acquisition, image sampling and quantization, Basic relationship between pixels, neighbours of a pixel, Types of images, Color models – RGB, CMY, YIQ, HSI, Statistical parameters.

Unit II: Image Enhancement **(04)**

Image Enhancement: Spatial domain methods, intensity transformations, histogram processing, Spatial filtering - smoothing filter, sharpening filter. Frequency domain filtering: low pass filtering, high pass filtering.

Unit III: Image Segmentation **(10)**

Thresholding, histogram based segmentation, Edge based segmentation, Clustering, Region growing, region splitting, watershed algorithm.

Unit IV: Image Feature Detectors and Descriptors **(10)**

Corner detectors, blob detector, SIFT, HOG, GLCM.

Unit V: Applications of Image Processing **(09)**

Face detection using Viola Jones algorithm, QR code recognition, Applications of AI in Image restoration, photo editing, old image colouring.

Reference Books:

1. R.C. Gonzalez, R.E. Woods, '**Digital Image Processing**', *Pearson Education,* (3rd Edition), (2014)
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar '**Digital Image Processing**', *McGraw-Hill*, (1st Edition), (2009)
3. K. Jain, **'Fundamentals of Digital Image Processing'**, *Prentice Hall*, (3rd Edition), (2004)
4. W.K. Pratt, '**Digital Image Processing**', *John Wiley & sons*, (3rd Edition), (2006)
5. Narendra Kumar Kamila, **'Handbook of Research on Emerging Perspectives in Intelligent Pattern Recognition, Analysis and Image Processing'**, *IGI Global*, (1st Edition), (2016)

20PEECAI 01 Soft Computing

Teaching Scheme:

Lectures: 3 Hrs/Week

Examination Scheme:

In-Semester: **50**Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To explain the concept of biological neuron and artificial neuron model
2. To introduce the soft computing technique namely, artificial neural networks and fuzzy logic
3. To explain the areas of application of soft computing techniques
4. To explain the alternative solutions to the conventional problem-solving techniques in the image/signal processing, pattern recognition/classification, control system

Course Outcomes:

After completion of the course, students will be able to

1. Explain the concepts of Artificial Neural Networks and its application for classification and regression
2. Describe the concepts of fuzzy logic and fuzzy inference system
3. Explain and analyze fuzzy control system
4. Apply soft computing techniques to solve real world problems

Unit I: Artificial Neural Network **(14)**

Biological Neuron , Artificial Neuron Model, Concept of Bias and Threshold, Topologies of NN, Learning Paradigms : Supervised, Unsupervised, reinforcement, Linear Neuron Model : Gradient decent algorithm, Application of linear neuron regression, Multilayer Perceptron and Back Propagation Algorithm, Applications of MLP for classification and regression, Self Organizing Feature maps, K-Means clustering, Learning Vector Quantization, Radial Basis Function network.

Unit II: Fundamentals of Fuzzy Logic **(11)**

Concept of fuzzy number, fuzzy set theory –continuous and discrete, Operations on fuzzy sets, Fuzzy membership Functions -core, boundary and support, primary and composite linguistic terms, Concept of fuzzy relation, Composition operation- T-norm and T-conorm, fuzzy if-then rules, Fuzzification, Membership value assignment Techniques, Defuzzification- Max membership principle, Centroid method, weighted average method, Concept of fuzzy inference, Implication rules – Dienes Rescher Implication, Mamdani Implication, Zadeh Implication, Fuzzy Inference System (FIS) – Mamdani fuzzy model, Sugeno fuzzy model, Tsukamoto fuzzy model, Implementation of single Output FIS employing Mamdani Model Computi

Unit III: Fuzzy Control System **(05)**

Control System Surface, Assumptions in Fuzzy control system design, Fuzzy controllers and comparison with traditional PID controllers, Advantages of Fuzzy Logic Controller (FLC), Architecture of FLC: Mamdani type.

Unit IV: Adaptive Neuro-Fuzzy Inference Systems (ANFIS) **(06)**

ANFIS Architecture, Hybrid learning Algorithm, Advantages and Limitations of ANFIS, Applications of ANFIS for regression.

Reference Books:

1. Laurene Fausett, **'Fundamentals of Neural Network: Architectures, Algorithms and Applications'**, *Pearson Education inc.*, (1st Edition), (2008)
2. S. N. Shivanandam, S. N. Deepa, **'Principles of Soft Computing'**, *John Wiley and sons*, (1st Edition),(2007)
3. Thomas ,Timothy, Ross, **'Fuzzy Logic with engineering Applications'**, *John Wiley and sons*, (1st Edition), (2010)
4. J. S. Jang, C.T. Sun, E. Mizutani, **'Neuro Fuzzy and Soft Computing'**, *PHI Learning Pvt. Ltd*, (1st edition), (2015)
5. Jaseck M. Zurada, **'Introduction to Artificial Neural Systems'**, *West Publishing co.*(1st edition),(1992)
6. Simon Haykins, **'Neural Networks A comprehensive foundation'**, *PHI, (1st Edition),* (1999)
7. Karry and De Silve, **'Soft computing and intelligent Systems :Theory, Tools, And Applications'**, *Pearson Education inc.*, (1st Edition), (2009)
8. http://www.nptelvideos.in/2012/11/intelligent-systems-and-control.html

Unit IV: Applications of Natural Language Processing **(08)**

Machine Translation, Sentiment Analysis, Question Answering Systems, Cross LingualInformation Retrieval, Natural Language Interface to Database, Extractive and AbstractiveSummarization Systems, Indian Language WordNets.

Reference Books:

1. Jurafsky, David, James H. Martin, '**Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition**', *Pearson Education Limited, Dorling Kindersley(India) Pvt. Ltd.*, (2014)

2. James Allen, '**Natural Language Understanding**', *Pearson Education Limited, Dorling indersley (India) Pvt. Ltd. (Indian Subcontinent Version)*(2007)

3. Manning, Christopher D., Hinrich Schütze, '**Foundations of Statistical Natural Language Processing**', *Cambridge Publication,*(1999)

4. Steven Bird, ewan Klein, and Edward Loper, '**Natural Language Processing with Python**', *O'Reilly Media*, (2009)

20ECAI 05 Natural Language Processing

Teaching Scheme:

Lectures: 3 Hrs/Week

Examination Scheme:

In-Semester: **50** Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To understand various aspects of Natural Language Processing
2. To learn Phonological, Morphological, Syntactic and Semantic processing
3. To understand issues related to ambiguity of Natural Language
4. To understand the advanced applications of Natural Language Processing

Course Outcomes:

After completion of the course, students will be able to

1. Explain the importance of Natural Language Processing
2. Identify the fundamental concepts and techniques of Natural Language Processing
3. Analyze ambiguous structure of Natural Language
4. Summarize the advanced applications of Natural Language Processing

Unit I: Introduction to Natural Language Processing Fundamentals of Phonetics **(09)**

The Study of Language, Evaluating language Understanding Systems, Different levels of Language Analysis, Speech Sounds and Phonetic Transcription, Articulatory Phonetics, Phonological Categories and Pronunciation Variation, Phonetic Features

Unit II: Fundamentals of Syntax **(09)**

The elements of Noun Phrases, Verb Phrases, Adjective Phrases, Adverbial Phrases and SimpleSentences, Grammars and Sentence Structure, Construction of a Good Grammar, A Top-DownParser, A Bottom-Up Chart Parser, Top-Down Chart Parsing, Part-of-Speech Tagging.

Unit III: Fundamentals of Semantics and Discourse **(10)**

Word Senses, Relations between Senses, WordNet, Word Sense Disambiguation, The Need forDiscourse Structure, Segmentation and Cue Phrases, Discourse Structure and Reference, Relating Discourse Structure and Inference, Discourse Structure, Tense and Aspect, Managingthe Attentional Stack, Concept of Pragmatics.

20ECAI 06 Data Analytics

Teaching Scheme:

Lectures: 3 Hrs/Week

Examination Scheme:

In-Semester: **50** Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To understand the concepts, challenges and techniques of Big Data and Big Data Analytics
2. To introduce the concepts of Hadoop, Map Reduce framework and 'R' for Big Data Analytics
3. To teach students to apply skills and tools to manage and analyze Big Data

Course Outcomes:

After completion of the course, students will be able to

1. Design and manage a Big Data application using Hadoop technology framework
2. Collect, manage, store, query and analyze various forms of Big Data using Map-Reduce and other Big Data tools
3. Apply Big Data Analytics tools for business decisions and strategy definition
4. Implement solutions to some of the open Big Data problems using R
5. Compare various Data Analytic Methods and trends

UNIT I: Introduction **(06)**

Database Management Systems, structured data, SQL, Big data overview, characteristics of Big Data, applications of Big Data, Unstructured data, NOSQL, advantages of NOSQL, Comparative study of SQL and NOSQL.

UNIT II: Big Data Architecture, Hadoop **(06)**

Challenges enabling real time big data processing, Hadoop – Introduction, building blocks of hadoop, Installing and configuring Hadoop.

UNIT III: MapReduce Fundamentals **(06)**

Components of Hadoop, HBASE, HIVE, Map Reduce Working, the Mapper and Reducer, InputFormats and OutputFormats, Introduction to HBASE, Sqoop, Spark.

UNIT IV: Big Data Analytics **(06)**

Data Analytical architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach, Data Analytic Life Cycle: Discovery, Data preparation, Model planning, Model Building, Communicate results, Operationalize, Case Study: Global Innovation Network

And Analysis (GINA).

UNIT V: Analytics using R **(06)**

R Fundamentals: Math, variables, strings, vectors, factors, vector operations, Data structures in R: Arrays and amp, Matrices, lists, data frames, R programming fundamentals: Conditions and loops, functions in R, Objects and Classes, Working with data in R: Reading CSV and Excel files, reading text files, writing and saving data objects to file in R.

UNIT VI: Data Analytic Methods and Trends **(06)**

Statistical Methods, Machine learning methods – supervised, unsupervised, recommendation systems, Big data visualization, Open source Tools / Techniques / Languages (R, Python).

Reference Books:

1. Vignesh Prajapati, '**Big Data Analytics with R and Hadoop**', *Packt Publishing*, (November 2013)
2. '**Data Science and Big Data Analytics**', *Wiley*, (1st Edition), (January 2015)
3. Abraham Silberschatz, Henry Korth, S. Sudarshan, '**Database Systems Concepts**', *McGraw Hill Education (India) Pvt Ltd,* (6th Edition), (December 2013)
4. Arvind Sathi, '**Big Data Analytics: Disruptive Technologies for Changing the Game**', *MC Press* (November 2012)
5. Viktor Mayer-Schonberger, Kenneth Cukier, '**Big Data: A Revolution that will transform how we live, work, and think**', *Hodder and Stoughton*, (October 2013)
6. J. Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, '**Big Data for Dummies**', *John Wiley & Sons, Inc.* (1st Edition), (April 2013)
7. Tom White, '**Hadoop: The Definitive Guide**', *O'Reilly*, (3rd Edition), (June 2012)

MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Dr. M. B. Khambete
Principal
MKSSS's Cummins College of Engineering For Women Karvenagar, Pune 411

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

20ECAI 07 Artificial Intelligence in Wireless Communications

Teaching Scheme:

Lectures: 3 Hrs/Week

Examination Scheme:

In-Semester: **50**Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To understand the cognitive radio systems in wireless communication
2. To understand artificial intelligence techniques applied in wireless communications
3. To understand functions of the software defined radio
4. To understand multi-objective optimization of Radio Resources

Course Outcomes:

After completion of the course, students will be able to

1. Describe Cognitive radio architecture, Cognitive engine design and its components
2. Discuss artificial intelligence techniques applied in Wireless Communications
3. Interpret basics of Software Defined Radio
4. Discuss Multi-objective Optimization of Radio Resources
5. Analyze an algorithm to perform the multi-objective analysis

UNIT I: Overview of Cognitive Radio and the Cognitive Engine **(07)**

Concept of Cognitive Radio, Cognitive Radio history, The Cognitive Engine: Cognitive Radio Design, Cognitive Engine Design, Component Descriptions – Sensors, Optimizer, Decision Maker, Policy Engine, Radio Framework, User Interface, Cognitive Controller Configuration.

UNIT II: Artificial Intelligence in Wireless Communications **(07)**

Artificial Intelligence Techniques- Neural Networks, Hidden Markov Models (HMM), Fuzzy Logic, Evolutionary Algorithms.

UNIT III: Overview and Basics of Software Defined Radios (SDR) **(07)**

Background, Benefits of Using SDR, Problems Faced by SDR, GNU Radio Design - The Universal Software Radio Peripheral, The USRP Version 2, Flow Graphs, Parallel Programming in GNU Radio, Flow Graph for Simulation and Experimentation.

UNIT IV: Optimization of Radio Resources **(07)**

Objective Space, Multi-objective Optimization: Objective Functions, Bit Error Rate (BER), Bandwidth, Spectral Efficiency, Interference, Signal to Interference Plus Noise Ratio (SINR), Throughput, Power, Computational Complexity. Multi-objective Optimization: A Different Perspective, Multi-objective Analysis- Utility Functions, Population-Based Analysis.

UNIT V: Genetic Algorithms for Radio Optimization **(08)**

Multi-objective Genetic Algorithms, Wireless System Genetic Algorithm – Details of Chromosome Structure, Objective Function Definition, Optimal Individual Selection.

References Books:

1. Thomas W. Rondeau and Charles W. Bostian, **'Artificial Intelligence in Wireless Communications'** *Artech House*, (1st Edition), (2009)
2. Joseph Mitola III, **'Software Radio Architecture: Object-Oriented Approaches To Wireless System Engineering'**, *John Wiley & Sons Ltd.*, (1st Edition), (2000)
3. Simon Haykin, **'Cognitive Radio: Brain –Empowered Wireless Communications'**, *IEEE Journal on Selected Areas in Communications*, (Feb 2005)
4. D. E. Goldberg, **'Genetic Algorithms in Search, Optimization, and Machine Learning, Reading'**, *MA: Addison-Wesley*, (1st Edition), (1989)

20ECAI 08 Deep Learning

Teaching Scheme:

Lectures: 3 Hrs./Week

Examination Scheme:

In-Semester: 50Marks

End-Semester: 50 Marks

Credits: 3

Course Objectives:

1. To learn basics of neural networks and deep learning
2. To understand training of deep neural networks and L-layers
3. To introduce various CNN architectures and transfer learning

Course Outcomes:

After completion of the course, students will be able to

1. Describe concepts of neural networks and apply modern software tools and libraries
2. Build and train L-layer deep neural network
3. Make use of hyper-parameter tuning and regularization methods for optimized model performance
4. Design a convolutional neural network for image recognition and classification applications
5. Apply transfer learning to train deep neural network for real-world applications
6. Analyze the models using various performance metrics

Unit I: Introduction to Deep Learning **(08)**

Overview of Neural networks- Biological neuron, Feedforward neural networks, Multi-layer perceptron (MLP), Shallow neural networks and Deep neural networks, Activation functions and loss function, Gradient descent and Backpropagation algorithm, Deep neural networks, Deep learning frameworks (Keras, TensorFlow, PyTorch, Caffe, Theano), Tensor representation, Building neural network architecture using TensorFlow, Role of GPU in deep learning.

Unit II: Tuning Deep Networks **(10)**

Deep network hyperparameters, L-Layers of Deep NN, Effect of adding hidden layers, Preparation of dataset, Bias and Variance, Dataset Augmentation, Overfitting, Regularization, Dropout, Early Stopping, Parameter Tying and Parameter Sharing, Weight initialization, Learning rate, ReLU and Softmax Function, Stochastic Gradient Descent (SGD), Batch and Mini Batch, Optimizers-Momentum, RMSProp, Adam, Cost functions.

Unit III: Convolutional Neural Network **(10)**

Convolutional Neural Network (CNN) architecture, Building blocks of CNN, Convolution

operation and layer, Kernels and Filters, Pooling layer, Stacking of layers, Vanishing/Exploding Gradients, Training of CNN, Accuracy and loss, Cross-validation, Performance metrics, Image classification examples using Deep Convolutional Neural Network.

Unit IV: Transfer Learning and Applications of Deep Learning **(08)**

Understanding and visualizing Convolutional Neural Networks, Modern CNN architectures- LeNet, AlexNet, VGG, GoogleNet, Inception, ResNet, U-Net, Transfer learning from modern CNN architectures, Deep learning for medical image interpretation, Deep learning for computer vision-object detection and recognition, Deep learning for sequence data and text data- Recurrent Neural Network (RNN), Long Short Term Memory networks (LSTM).

Reference Books:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, **'Deep Learning'**, *MIT Press*, (1st Edition), (2016)
2. Francois Chollet, **'Deep Learning with Python'**, *Manning Publications,* (1st Edition), (2018)
3. Phil Kim, '**MATLAB Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence'**, *Apress*, (1st Edition), (2017)
4. Josh Patterson and Adam Gibson, **'Deep Learning- A Practitioner's Approach'**, O'Reilly Media, (1st Edition), (2017)
5. Laurene Fausett, **'Fundamentals of Neural Networks: Architectures, Algorithms and applications'**, *Pearson Education*, (1st Edition), (2008)

20ECAI 09 Research Methodology

Teaching Scheme:
Tutorial: 1 Hr /Week

Examination Scheme:
In-Semester: 25Marks
Credits: 1

Course Objectives:

1. To understand basic concepts of research and research methodology
2. To understand principles behind Research Problem formulation
3. To study Instrumentation schemes for Data collection
4. To prepare a research/ project proposal

Course Outcomes:

After completion of the course, students will be able to

1. Formulate Research Problems
2. Design and Analyze schemes for Data collection
3. Write research proposals
4. Write Technical Papers

Unit I: Research Problem **(03)**

Research and research problem, sources of research problem, criteria / Characteristics of a good research problem, Literature Review, Scope and objectives of research problem, Hypothesis its importance and construction, Selecting a sample.

Unit II: Data Collection Design **(03)**

Data Collection, Form design and Data processing.

Unit III: Research Proposal **(04)**

Developing a Research Proposal and writing a research report. Format of research proposal, Individual research proposal, Institutional proposal, Report writing, Technical Paper writing.

Reference Books:

1. S. Melville, W. Goddard, **'Research Methodology: An introduction for Science & Engineering students'**, *Juta and Company* ,(1st Edition), (1996)
2. R. Kumar, **'Research Methodology: A Step by Step Guide for Beginners'**, *Pearson Education*, (2nd Edition), (2005)
3. Dr. C. R. Kothari, **'Research Methodology: Methods and Techniques'**, *New Age Publication*, (2nd Edition), (2010)
4. R. Panneerselvam, **'Research Methodology'**, *PHI Learning*, (2nd Edition), (2014)

20PEECAI 02 Computer Vision

Teaching Scheme:

Lectures: 3 Hrs./Week

Examination Scheme:

In-Semester: **50**Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To understand computer vision fundamentals and applications
2. To understand feature detection, matching and image recognition applications
3. To learn image segmentation, motion estimation, activity recognition tasks

Course Outcomes:

After completion of the course, students will be able to-

1. Describe the computer vision system and its applications
2. Identify image features and apply feature detection and matching methods
3. Detect objects and pedestrian for autonomous vehicles
4. Apply image segmentation techniques for medical imaging applications
5. Apply motion estimation algorithms to detect and track motion in video
6. Build a computer vision system for gesture recognition

Unit I: Computer Vision for Autonomous vehicles **(09)**

Self-Driving cars, Advanced Driver Assistant System- Tasks and Challenges, Case study- Lane detection, Pedestrian detection from the road scene.

Unit II: Computer Vision for Disease Diagnosis **(09)**

Medical imaging- X-ray, CT and MRI; Case study- Medical image segmentation for Tumour detection, Tumour classification as cancerous or non-cancerous.

Unit III: Computer Vision for Video Surveillance **(10)**

Surveillance and vision based tasks, Foreground-Background Separation, Background Subtraction and Modelling, Motion tracking- Optical Flow. Case study- Human activity recognition.

Unit IV: Computer Vision for Gesture Recognition **(08)**

Human Computer Interaction (HCI), Hand gestures, Detection- color and shape features, Tracking, feature matching, Gesture Recognition system using Convolutional Neural Networks.

Reference Books:

1. Richard Szeliski, **'Computer Vision: Algorithms and Applications'**, *Springer-Verlag London Limited*, (1st Edition), (2011)

2. D. A. Forsyth, J. Ponce, **'Computer Vision: A Modern Approach'**, *Pearson Education*, (1st Edition), (2003)

3. L. G. Shapiro, George C. Stockman, **'Computer Vision'**, *Prentice Hall*, (1st Edition), (2001)

4. E. Trucco, A. Verri, **'Introductory Techniques for 3-D Computer Vision'**, *Prentice Hall* (1st Edition), (1998)

5. M. Shah, **'Fundamentals of Computer Vision'**, *Online book* (1997)

MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Dr. M. B. Khambete
Principal
MKSSS's Cummins College of Engineering For Women Karvenagar, Pune 411052.

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

20PEECAI 02 Virtual Reality

Teaching Scheme:

Lectures: 3 Hrs./Week

Examination Scheme:

In-Semester: **50**Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To understand fundamental concepts and components of Virtual Reality
2. To study the input-output interface in Virtual Reality
3. To study visual computation in Virtual Reality
4. To understand Environment Modeling and interactive techniques
5. To study the system structure of Augmented Reality

Course Outcomes:

After completion of the course, students will be able to

1. Explain perceptual concepts governing virtual reality
2. Identify and solve the issues of various virtual reality frameworks
3. Design immersive experience using virtual reality Software

Unit I: Introduction of Virtual Reality (VR) **(06)**

Fundamental Concept and Components of Virtual Reality, Primary Features and Present Development on Virtual Reality.

Unit II: Multiple Modals of Input and Output Interface in Virtual Reality **(06)**

Input -Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus and 3DScanner, Output -Visual / Auditory / Haptic Devices.

Unit III: Visual Computation in Virtual Reality **(06)**

Fundamentals of Computer Graphics (CG), Software and Hardware Technology on Stereoscopic Display, Advanced Techniques in CG: Management of Large Scale Environments and Real Time Rendering.

Unit IV: Environment Modeling and Interactive Techniques in Virtual Reality **(06)**

Environment Modeling: Geometric Modeling, Behavior Simulation, Physically Based Simulation Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp.

Unit V: Introduction of Augmented Reality **(06)**

System Structure of Augmented Reality (AR), Key Technology in AR.

Unit VI: Application of VR in Digital Entertainment **(06)**

VR Technology in Film and TV Production, VR Technology in Physical Exercises and Games.

Reference Books:

1. Burdea, G. C. and P. Coffet., "**Virtual Reality Technology**", *Wiley-IEEE Press*, (2nd Edition) (2003/2006).

2. Sherman, William R. and Alan B. Craig., **"Understanding Virtual Reality–Interface, Application, and Design"**, *Morgan Kaufmann*, (2002).

3. Fei GAO, "**Design and Development of Virtual Reality Application System**", *Tsinghua Press*, (March 2012).

20AC 01 Soft Skills and Business Communication

Teaching Scheme:

Practical: 2 Hrs/Week

Examination Scheme:

In-Semester: **Nil**

End-Semester: **Nil**

Credits: Nil

Course Objectives:

1. To develop team spirit, leadership and professionalism.
2. To focus on over all personality development.
3. To develop right attitudinal and behavioral aspects, and build the same through activities.
4. Possess right professional and social ethical values.
5. To make student confident in communicating in Business environment.
6. Improve their fluency in English language.

Course Outcomes:

After completion of the course, students will be able to

1. Communicate, interact and present his ideas to other professionals.
2. Explain role and contents of soft skills through instructions, knowledge acquisition, demonstration and practice.
3. Develop right attitudinal and behavioral aspects, and build the same through activities.
4. Develop right professional and social ethical values.
5. Overcome apprehension of communicating in professional environment.
6. Language proficiency will enable student to present ideas, applications and reports effectively in oral and written communication.

Unit I: Self-Awareness & self-Development **(03)**

a) Self Assessment, Self Appraisal, SWOT, Goal setting -Personal &career-Self-Assessment, Self- Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self appraisal, Personal Goal setting.

b) Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, prioritization.

Unit II: Communication Skill **(06)**

a) Importance of communication, types, barriers of communication, effective communication.

b) Speaking Skills– Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self-expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.

c) Listening Skills: Law of nature- you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, Avoid selective listening.

d) Group Discussion- characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.

e) Presentation skills- planning, preparation, organization, delivery.

f) Written Skills– Formal & Informal letter writing, Report writing, Resume writing- Sentence structure, sentence coherence, emphasis. Paragraph writing, Letter writing skills-form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.

Unit III: Corporate/ Business Etiquettes. **(02)**

Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting- Understand the importance of professional behavior at the workplace, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment), Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.

Unit IV: Interpersonal relationship **(03)**

Team work, Team effectiveness, Group discussion, Decision making - Team Communication Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity.

Unit V: Leadership skills **(01)**

Leaders' role, responsibilities and skill required- Understanding good Leadership behaviours, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules, Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions,

Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback.

Unit VI: Other skill **(03)**

a) Time management-The Time management matrix, apply the Pareto Principle (80/20Rule) to time management issues, to prioritize using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions, to maximize your personal effectiveness, how to say "no" to time wasters, develop your own individual plan of action.

b) Stress management- understanding the stress & its impact, techniques of handling stress

c) Problem solving skill, Confidence building Problem solving skill, Confidence building.

Reference Books:

1. S. Kumar, S.Pushpalata, **'Communication Skills'**, *Oxford University Press,* (1st Edition), (2011)
2. K. Mohan, M. Banerji, **'Developing Communication Skill'** , *McMillan India Ltd,* (1st Edition), (2011)
3. S. Sweeney, **'English for Business Communication'** *Cambridge University Press,*(1st Edition), (2013)
4. B. K. Mitra, **'Personality Development and Group Discussions'**, *Oxford University Press,* (1st Edition),(2010)
5. S. Napoleon Hill **'Think and Grow Rich'**, *Ebury Publishing,*(1st Edition), (1937)

MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Dr. M. B. Khambete
Principal
MKSSS's Cummins College of Engineering For Women Karvenagar, Pune 411052.

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

20AC 01 Entrepreneurship Development

Teaching Scheme:

Practical: 2 Hrs/Week

Examination Scheme:

In-Semester: **Nil**

End-Semester: **Nil**

Credits: **Nil**

Course Objectives:

1. Understand the fit between individual entrepreneurial ambitions
2. Select a problem worth solving
3. Identify the customers
4. Develop a solution for your customers' problems and problem solution
5. Build and demonstrate an MVP (Minimum Viable product)
6. Structure a business model around the problem, customer, and solution and present Business Model Canvas

Course Outcomes:

After completion of the course, students will be able to

1. Explain what it takes to be an entrepreneur
2. Analyze business opportunities and the basics to create, launch and manage new businesses
3. Develop Business Model for their Idea/Problem
4. Create MVP (Minimum Viable Product)

Unit I: Introduction to Entrepreneurship development **(3)**

Discover yourself, Principles of Effectuation, Identify your entrepreneurial style.

Unit II: Problem Identification and Idea generation **(3)**

Identify Problems worth Solving, Introduction to Design Thinking, Generate ideas that are potential solutions to the problem identified.

Unit III: Customer Segmentation **(3)**

Customer identification, Market, Creative solution, Unique Value proposition.

Unit IV: Business Model Canvas **(3)**

Types of business models, Business Plan documentation, Risk identification.

Unit V: Validation **(3)**

Identification of MVP, Solution development, Building products/services, Build-measure-learn loop for development, Market fit of solution.

Reference Books:

1. P. M. Charantimath, **'Entrepreneurship Development and Small Business Enterprises'**, *Pearson Education India* (2nd Edition),(2005)
2. V. Desai, **'Dynamics of Entrepreneurial Development and Management'**, *Himalaya Publishing House,* (4th Edition),(2007)
3. J. Forbat, **'Entrepreneurship'**, *New Age International Pvt Limited*, (1st Edition),(2008)
4. J. L. Massod, **'Essential of Management'**, *Prentice Hall of India,* (4th Edition), (1986)
5. Effectuation: https://necrophone.com/2014/01/20/effectuation-the-best-theory-of-ntrepreneurship-you-actually-follow-whether-youve-heard-of-it-or-not/
6. The Lean BMC: https://www.youtube.com/watch?v=FjB_e7UO1hc

20PEECAI 03 Reinforcement Learning

Teaching Scheme
Lectures: 3 Hrs / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objective:

1. To explain Reinforcement Learning tasks, principles and value functions
2. To introduce to the tabular methods to solve classical control problems
3. To explain the policy gradient methods
4. To explain the current advanced techniques and applications in Reinforcement Learning

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

1. Explain the principles of Reinforcement Learning
2. Apply tabular methods to solve control problems
3. Explain and analyze deep Q-network based algorithms
4. Describe the applications of Reinforcement Learning

Unit I : Basics of Reinforcement Learning (RL) **(08)**
Introduction and Basics of RL, Defining RL Framework and Markov Decision Process, Policies, Value Functions and Bellman Equations, Exploration vs. Exploitation, Code Standards and Libraries used in RL (Python/Keras/Tensorflow).

Unit II : Tabular Methods and Q-networks **(08)**
Planning through the use of Dynamic Programming and Monte Carlo, Temporal-Difference learning methods (TD(0), SARSA, Q-Learning), Deep Q-networks (DQN, DDQN, Dueling DQN, Prioritized Experience Replay).

Unit III : Policy Optimization **(08)**
Introduction to policy-based methods, Vanilla Policy Gradient, Reinforce Algorithm and stochastic policy search, Actor-critic methods, Advanced policy gradient, Model based RL.

Unit IV : Model-based RL and Applications **(12)**
Model-based RL approach, Recent Advances and Applications, Meta-learning, Multi-Agent Reinforcement Learning, Partially Observable Markov Decision Process, Ethics in RL, Applying RL for real-world problems.

Reference Books:

1. Stuart Russell, Peter Norvig, **'Artificial Intelligence, A Modern Approach'**, *Pearson Education/Prentice Hall of India,* (3rd Edition), (2010)
2. Richard S. Sutton and Andrew G. Barto, **'Reinforcement learning: An Introduction'**, *MIT Press*, (2nd Edition), (2019)
3. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville., **'Deep Learning'**, *MIT press*, (1st Edition), (2016)
4. Wiering, Marco, and Martijn Van Otterlo., **'Reinforcement Learning- Adaptation, learning, and optimization'**, (1st Edition), (2012)
5. https://www.davidsilver.uk/teaching/
6. https://deepsense.ai/what-is-reinforcement-learning-the-complete-guide/
7. https://towardsdatascience.com/applications-of-reinforcement-learning-in-real-world-1a94955bcd12

MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Dr. M. B. Khambete
Principal
MKSSS's Cummins College of Engineering For Women Karvenagar, Pune 411052.

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

20PEECAI 03 Applications of Artificial Intelligence

Teaching Scheme:

Lectures: 3 Hrs/Week

Examination Scheme:

In-Semester: **50**Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To explain the machine learning techniques for disease diagnosis and clinical decision support system
2. To explain the concepts of machine learning applied to cyber security
3. To explain the concepts of machine learning applied to the field of robotics

Course Outcomes:

After completion of the course, students will be able to

1. Describe the machine learning techniques for healthcare, cyber security and robotics
2. Apply the machine learning techniques for healthcare, cyber security and robotics
3. Analyze and compare the machine learning techniques for healthcare, cyber security and robotics

Unit I: Application of Artificial Intelligence in Cyber Security **(12)**

Malicious event detection (worms, viruses), Emails fraud and spam, Network Anomaly detection, Network traffic identification, Knocking down CAPTACHS.

Unit II: Application of Artificial Intelligence in Robotics **(12)**

Mobile Robot: path planning and Navigation, Human Robot (Humanoid): Teaching a Robot to Listen and Talk, Teaching the robot arm for pick and place operation, Adaptive learning rate and use of Genetic algorithms.

Unit III: Application of Artificial Intelligence in Healthcare **(12)**

Diagnosing of disease using Machine learning, Machine learning in Ultrasound Imaging, biomedical signal processing, Robotics in Healthcare Industry, Mobile App enabled system for Healthcare, Clinical Decision Support Systems of Health Care.

Reference Books:

1. Soma Halder, Sinan Ozdemir, **"Hands-On Machine Learning for Cybersecurity: Safeguard your system by making your machines intelligent using the Python ecosystem"** , *Packet publishing ltd.*, (1st Edition), (2018)

2. Francis X. Govers, "**Artificial Intelligence for Robotics**", *Packt Publishing Ltd. United Kindom*, (1st Edition), (2018).

3. Robin R. Murphy, "**Introduction to Artificial Intelligence for Robotics**", *The MIT Press*, (2nd Edition), (2000).

4. Peter Corke, "**Robotics,Vision and Control:Fundamental Algorithms in MATLAB**", *Springer*, (2nd Edition), (2017).

5. R. Siegwart, I. R. Nourbakhsh, "**Introduction to Autonomous Mobile Robots**", *The MIT Press*, (2nd Edition), (2011)

6. Francis X. Campion, Gunnar Carlsson, "**Machine learning in Health Care**", *CreateSpace Independent Publishing Platform*, (1st Edition), (2017)

7. Arjun Panesar, "**Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes**", *Apress*, (1st Edition), (2019)

8.https://www.researchgate.net/publication/334875817_Machine_Learning_Internet_of_Medical_Things_in_Healthcare

9.https://www.researchgate.net/publication/283083699_Applications_of_Machine_Learning_in_Cyber_Security

MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Dr. M. B. Khambete
Principal
MKSSS's Cummins College of Engineering For Women Karvenagar, Pune 411052.

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052