Punyashlok Ahilyadevi Holkar Solapur University, Solapur

पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ
।। विद्यया संपन्नता ।।

NAAC Accredited 2022
'B^{++}' Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

Choice Based Credit System

Syllabus: Computer Science & Engineering

Name of the Course: M. Tech. II (Sem.– III & IV)

(Syllabus to be implemented June 2024)

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
STRUCTURE OF M. Tech. (COMPUTER SCIENCE & ENGINEEING)
Four Semester Course
Choice Based Credit System Syllabus w.e.f. 2023-24
Semester-I

Sr. No.	Subject	Teaching Scheme				Credits				Evaluation Scheme				
		L	T	P	Total	Credits (L)	Credits (T)	Credits (P)	Total Credits	Scheme	Theory Marks	ICA- P Marks	ICA-T Marks	Total Marks
1	Applied Algorithms	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
2	Theory of Computation	3	1	-	4	3.0	1.0		4.0	ISE	30	--	25	125
										ESE	70	--	--	
3	Data Mining	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
4	Machine Learning©	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
5	Elective I	3	1	-	4	3.0	1.0	-	4.0	ISE	30	--	25	125
										ESE	70	--	--	
6	Seminar- I	-	-	2	2	-	-	2.0	2.0	ISE	--	50	--	50
										ESE	--	--	--	
Total		**15**	**2**	**8**	**25**	**15.0**	**2.0**	**5.0**	**22.0**		**500**	**125**	**50**	**675**

Note : *L- Lectures, P-Practical, T-Tutorial, ISE- In Sem Evaluation, ESE- End Semester Evaluation, ICA- Internal Continuous Assessment*

© - This Course is common for M.Tech. (Electronics Engineering) and M.Tech. (Computer Science & Engineering)

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
STRUCTURE OF M. Tech. (COMPUTER SCIENCE & ENGINEERING)
Four Semester Course
Choice Based Credit System Syllabus w.e.f. 2023-24
Semester-II

Sr. No.	Subject	Teaching Scheme				Credits				Evaluation Scheme				
		L	T	P	Total	Credits (L)	Credits (T)	Credits (P)	Total Credits	Scheme	Theory Marks	ICA- P Marks	ICA-T Marks	Total Marks
1	Research Methodology & IPR©	3	1	-	4	3.0	1.0	-	4.0	ISE	30	--	25	125
										ESE	70	--	--	
2	Internet of Things	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
3	Internet Routing Algorithm	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
4	Elective – II	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
5	Elective – III	3	1	-	4	3.0	1.0	-	4.0	ISE	30	--	25	125
										ESE	70	--	--	
6	Seminar- II	-	-	2	2	-	-	2.0	2.0	ISE	--	50	--	50
										ESE	5 --	--	--	
Total		**15**	**2**	**8**	**25**	**15.0**	**2.0**	**5.0**	**22.0**		**500**	**125**	**50**	**675**

Note : *L- Lectures, P-Practical, T-Tutorial, ISE- In Semester Evaluation, ESE- End Semester Evaluation, ICA- Internal Continuous Assessment*
© - This Course is common for M.Tech. (Electronics Engineering) and M.Tech. (Computer Science & Engineering)

- Seminar I shall be delivered on a topic related to student's broad area of interest for dissertation work selected in consultation with the advisor after compiling the information from the latest literature. Student shall deliver seminar using modern presentation tools. A hard copy of the report (as per format specified by the department) shall be submitted to the Department before delivering the seminar. A PDF copy of the report must be submitted to the advisor along with other details if any.

- Seminar II shall be delivered on a topic related to student's particular area of interest for dissertation work selected in consultation with the advisor after compiling the information from the latest literature. Student shall deliver seminar using modern presentation tools. A hard copy of the report (as per format specified by the department) shall be submitted to the Department before delivering the seminar. A PDF copy of the report must be submitted to the advisor along with other details if any.

- **List of elective courses for semester I and II -**

Sr. No.	***Elective - I***	***Elective – II***	***Elective – III***
1	Natural Language Processing	Deep Learning	Wireless Sensor Network
2	Computer Vision	Advanced Cloud Computing	Infrastructure Management
3	Soft Computing	High Performance Computing	Real Time Operating System
4	Object Oriented Software Engineering	Software Defined Network	Advances in Database Systems

- Courses may be added in the list of Elective I, Elective II and Elective III as and when required.

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
STRUCTURE OF M.Tech. (COMPUTER SCIENCE & ENGINEEING)
Four Semester Course
Choice Based Credit System Syllabus w.e.f. 2024-25
Semester-III

Sr. No.	*Subject*	*Teaching Scheme*		*Credits*			*Evaluation Scheme*			
		L	*P*	*Credits (L)*	*Credits (P)*	*Total Credits*	*Scheme*	*Theory Marks*	*ICA- P Marks*	*Total Marks*
1	Self-Learning Course	$	-	3.0	-	3.0	ISE	30	--	100
							ESE	70		
2	Open Elective Course#	3		3.0		3.0	ISE	30		100
							ESE	70		
3	Dissertation Phase I : Synopsis Submission Seminar*		@4		3.0	3.0	ISE	--	100	100
							ESE	--	--	
4	Dissertation Phase II : ICA*		-		3.0	3.0	ISE	--	100	100
							ESE	--	--	
5	Dissertation Phase II Progress Seminar*		-		3.0	3.0	ISE	--		100
							ESE	--	100	
Total		**3**	**4**	**6.0**	**9.0**	**15.0**		**200**	**300**	**500**

L- Lectures, P-Practical, T-Tutorial, ISE- In Semester Evaluation, ESE- End Semester Evaluation, ICA- Internal Continuous Assessment

Note -

- $- Being a Self Learning Course, student shall prepare for examination as per specified syllabus
- *- For all activities related to dissertation Phase I (synopsis submission seminar and progress seminar) student must interact regularly every week with the advisor.
- # - This course is common for all branches of Technology (ie for all M.Tech. Programs)

- Synopsis submission seminar shall cover detailed synopsis of the proposed work. Student shall submit synopsis of the dissertation work only after delivering this seminar.
- Progress seminar shall be delivered capturing details of the work done by student for dissertation
- Student shall deliver all seminars using modern presentation tools. A hard copy of the report shall be submitted to the department before delivering the seminar. A PDF copy of the report must be submitted to the advisor along with other details if any
- @ Indicates contact hours of students for interaction with advisor.
- Details of modes of assessment of seminar and dissertation shall be as specified in 7(III) of PG Engineering Ordinance of Solapur University, Solapur

Sr. No.	***Self-Learning Subject***	***Sr. No.***	***Open Elective Course Subject***
1	Big Data	1	Business Analytics
2	Computer Network Administration	2	Operation Research
3	Open Source Technologies	3	Cost Management of Engineering Projects
4	Usability Engineering	4	Non-Conventional Energy
		5	Product Design and Development

- New Self Learning Courses and New Open Elective Courses may be added as and when required

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
STRUCTURE OF M.Tech. (COMPUTER SCIENCE & ENGINEEING)
Four Semester Course
Choice Based Credit System Syllabus w.e.f. 2024-25
Semester-IV

Sr. No.	*Subject*	*Teaching Scheme*			*Credits*			*Evaluation Scheme*		
		L	*P*	*Total*	*Credits (L)*	*Credits (P)*	*Total Credits*	*Scheme*	*ICA- P Marks*	*Total Marks*
1	Dissertation Phase III : Progress Seminar #	-	4@	4	-	3.0	3.0	ISE	100	100
2	Dissertation Phase IV: #	-	2@	2	-	6.0	6.0	--	200	200
3	Final Submission of the Dissertation and Viva –Voce	-	-	-	-	6.0	6.0	ES	200	200
	Total	**-**	**-**	**6**	**--**	**15.0**	**15.0**	**-**	**500**	**500**

Note –

- #- For all activities related to dissertation Phase III & IV student must interact regularly every week with the advisor.
- Progress seminar shall be delivered capturing details of the work done by student for dissertation
- Student shall deliver all seminars using modern presentation tools. A hard copy of the report shall be submitted to the Department before delivering the seminar. A PDF copy of the report must be submitted to the advisor along with other details if any.
- Student must submit a hard copy of Project Report to the department
- @ indicates contact hours of the student for interaction with the advisor
- Details of modes of assessment of seminar and dissertation shall be as specified in 7 (III) of PG Engineering Ordinance of Solapur University, Solapur.

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER I
1. APPLIED ALGORITHMS

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Practical – 2 Hour/week, 1 Credit

Examination Scheme
ESE –70 Marks
ISE – 30 Marks
ICA –25 Marks

SECTION-I

Unit 1 Foundations **(6)**

Algorithms, Performance of algorithms, Growth of Functions-Asymptotic notation, Amortized analysis, Solving recurrences- Substitution method, Master method

Unit 2 Graph Algorithms **(6)**

Minimum spanning tree –Prim's and Krushkal's Algorithm for, Single-Source Shortest Paths-The Bellman- Ford algorithm and Dijkstra"s algorithm, Maximum Flow-Flow networks, The Ford-Fulkerson Algorithm, Huffman codes.

Unit 3 Dynamic Programming **(6)**

Matrix-chain multiplication, longest common subsequences, All-Pairs Shortest Paths, The Floyd-Warshall algorithm, Johnson Algorithm, optimal binary search tree, Reliability Design.

Unit 4 Backtracking **(5)**

The general method, 8-queen problem, sum of subset, knapsack problem.

SECTION-II

Unit 5 Computational Geometry **(8)**

Prerequisites – Basic properties of line, intersection of line, line segment, polygon etc. Line segment properties, detaining segment intersection in time complexity, Convex full problem – formulation, solving by Graham scan algorithm, Jarvis march algorithm, closest pair of points

Unit 6 NP-Completeness and Approximation Algorithms **(7)**

NP-Completeness: NP-completeness and reducibility, NP-completeness proof, NP-complete problems, Approximation algorithms: The vertex-cover problem, The traveling-salesman problem, The set covering problem, The subset-sum problem

Unit 7 Applied Algorithms **(7)**

Number-Theoretic: Number Theoretic notion, Greatest common divisor, The Chinese remainder theorem, RSA. String Matching Algorithms: The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm. Parallel Algorithm: Mesh Algorithm and its applications. Probabilistic Algorithm: Game Theoretic Techniques. Randomized Algorithms: Definition, Monte Corlo and Las Vegas algorithms

---

Internal Continuous Assessment (ICA):
Minimum 6 to 7 assignments based on above topics.

Text Books

1. Ellis Horowitz, Sartaj Sahni, - Fundamental of Computer Algoritms, Universities Press, II Edition
2. Bressard ,Bratley - Fundamental of Algorithms, PHI, 2nd Edition
3. Thomas H. Cormen and Chales E.L. Leiserson, Introduction to Algorithm‖, PHI, 2nd Edition

Reference Books

1. A.V.Aho and J.D.Ullman, Design and Analysis of Algorithms, Addition Wesley, 2nd Edition

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER I
2. THEORY OF COMPUTATION

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Tutorial – 1 Hour/week, 1 Credit

Examination Scheme
ESE - 70 Marks
ISE - 30 Marks
ICA – 25 Marks

SECTION I

Unit 1: Introduction: **(6)**

Introduction To Finite Automata: Alphabets and languages - Deterministic Finite Automata – Non Deterministic Finite Automata - Equivalence of Deterministic and Non-Finite Automata Languages Accepted by Finite Automata - Finite Automata and Regular Expressions – Properties of Regular sets & Regular Languages and their applications. Context Free Language : Context - Free Grammar – Regular Languages and Context-Free Grammar –Pushdown Automata - Pushdown Automata and Context-Free Grammar – Properties of Context – Free Languages - Pushdown Automata and Equivalence and Context Free Grammar.

Unit 2: Turing machine: **(5)**

Turing machines, variants of TMs, programming techniques for TMs, TMs and computers.

Unit 3: Decidability: **(5)**

Decidable languages, decidable problems concerning Context-free languages. The halting problem – Diagonalization method, halting problem is undecidable, Semi-Decidable Problems, classification of decidability, Undecidability.

SECTION II

Unit 4: Reducibility: **(6)**

Undecidable problems from language theory, Regular expressions, Turin g machines, Reduction, A simple undecidable problem (PCP), mapping reducibility and other undecidable problems, Rice theorem and problems on Undecidability with reducibility.

Unit 5 Computability: **(6)**

Primitive recursive functions, more examples, the recursion theorem, Computable and non-Computable problems, examples.

Unit 6 Computational Complexity: **(6)**

Tractable and Interactable problems, Growth rates of functions, Time complexity of TM, Tractable decision problems, Theory of Optimization, solvable v/s. Unsolvable Problems, Decidable v/s. Undecidable Problems, P v/s NP Problems, major problems in Computational Complexity.

Internal Continuous Assessment (ICA):

Assignments: Minimum 8 assignments based on above topics.

Text Books:

1. Introduction to Theory of Computation - Michael Sipser (Thomson Brools Cole)
2. Introduction to Automata Theory, Languages and Computation - J. E. Hoperoft, Rajeev Motawani and J.D. Ullman (Pearson Education Asia) 2nd Edition.

3. Theory of Computer Science – E. V. Krishnamoorthy
4. Introduction to languages & theory of computation -- John C. Martin (MGH)

References:

1. Theory of Computation- A Problem Solving Approach - Kavi Mahesh (Wiley India)
2. Theory of Computation - Dr. O.G.Kakde (University Science Press)
3. Formal Languages & Automata Theory - Basavraj S. Anami, Karibasappa K.G., Wiley Precise Textbook-Wiley India
4. Theory of Computation - Rajesh K Shukla (CENGAGE Learning)

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER I
3. DATA MINING

Teaching Scheme
Lectures– 3 Hours/week, 3 Credits
Practical – 2 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION-I

Unit 1 : Introduction **(3)**

Data Warehousing and Introduction to data mining basic elements of data warehousing, Data warehousing and OLAP.

Unit 2 : Data model development for Data Warehousing: **(3)**

Business model, selection of the data of interest, creation and maintaining keys, modeling transaction, data warehousing optimization.

Unit 3 : Data warehousing methodologies **(3)**

Type and comparisons.

Unit 4 : Data Mining techniques **(6)**

Data mining algorithms, classification, Decision- Tree based Classifiers clustering, association Association- Rule Mining Information Extraction using Neural Networks.

Unit 5 : Knowledge discovery

KDD environment

SECTION-II

Unit 6 : Visualization

Data generalization and summarization-based characterization, Analytical characterization: analysis of attribute relevance, mining class Comparison, Discriminating between classes, mining descriptive statistical measures in large database.

Unit 7 : Data mining primitives, la guages & system architectures **(4)**

Data mining primitives, Query language, designing GUI based on a data mining query language, architectures of data mining systems.

Unit 8 : Advanced topics **(3)**

Spatial mining, temporal mining.

Unit 9 : Web mining **(3)**

Web content mining, web structure ining, web usage mining

Unit 10 : Application and trends in data mining **(4)**

Applications, systems products and research prototypes, multimedia data mining, indexing of multimedia material, compression, space modeling.

Internal Continuous Assessment (ICA) :
Assignments: Minimum 5 to 6 assignments based on above topics.

Text books:

1. Paulraj Ponniah, ―Web warehousing fundamentals‖ – John Wiley.
2. M. H. Dunham, ―Data mining introductory and advanced topics‖ – Pearson education
3. Han, Kamber, ―Data mining concepts and techniques‖, Morgan Kaufmann

Reference Book :

Imhoff, Galemmo, Geiger, - Mastering data warehouse design‖, Wiley DreamTech

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER I

4. MACHINE LEARNING

Teaching Scheme
Lectures– 3 Hours/week, 3 Credits
Practical – 2 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION-I

Unit 1 Introduction **(6)**

Machine learning: what and why?, Supervised learning, Unsupervised learning, Some basic concepts in machine learning, Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation. *(Chapter 1 from Book 1, Chapter 1 from Book 2)*

Unit 2 Linear and Logistic Regression **(7)**

Linear regression: Introduction, Model specification, Maximum likelihood Robust linear regression, Ridge regression, Bayesian linear regression estimation (least squares), Logistic regression:Introduction, M del specification, Model fitting, Bayesian logistic regression, Online learning and stochastic optimization, Generative vs discriminative classifiers.
(Chapter 7 and 8 from Book 2)

Unit 3 Decision Tree Learning and Ensemble Methods **(8)**

Representing concepts as decision trees. Recursive induction of decision trees. Picking the best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity. Occam's razor. Overfitting, noisy data, and pr ning, Ensemble Methods: Bagging and Boosting *(Chapter 3 from Book 1, Chapter 14 from Book 3)*

SECTION-II

Unit 4 Clustering **(6)**

Introduction, Dirichlet process mixture models, Affinity propagation, Spectral clustering, Hierarchical clustering, Clustering datapoints and features, Applications of Clustering. *(Chapter 25 from Book 2)*

Unit 5 Sparse Kernel Machines **(6)**

Introduction to Support Vector Machines (SVM), Maximum Margin Classifiers, Machines. Applications of Support Vector Machines. *(Chapter 7 from Book 3)*

Unit 6 Neural Networks and Deep Learning **(4)**

Feed-forward Network Functions, Network Training, Error Backpropagation, Regularization in Neural Networks. *(Chapter 5 from Book 3, Chapter 28 from Book 2)*

Unit 7 Key Ideas in Machine Learning **(4)**

Introduction, Key Perspectives on Machine Learning, Key Results, Future of Machine Learning. (Chapter 14 of upcoming 2nd Edition of Book 1)

Unit 8 Applications of Machine Learning **(4)**

Applying Learning to Real Problems, Classifying Images, Scoring Opinions and Sentiments, Recommending Products and Movies, Using Machine Learning to Provide Solutions to Business Problems, Future of Machine Learning. *(Chapter 8 of upcoming 2nd Edition of Book 4)*

Internal Continuous Assessment (ICA) :

ICA shall be based upon minimum 6 laboratory experiment based upon above curriculum.

Text Books:

1. Machine Learning For Dummies, IBM Limited Edition by Judith Hurwitz, Daniel Kirsch (Published by Wiley, First edition).
2. Machine Learning For Dummies by John Paul Mueller, Luca Massaron (Published by For Dummies; First edition).

Reference Books:

- Book 1: Machine Learning by Tom Mitchell, McGraw Hill (1st Edition) + New chapters from the upcoming second edition.
- Draft content of chapter 14 of upcoming 2nd Edition of Book 1 http://www.cs.cmu.edu/~tom/mlbook/keyIdeas.pdf
- Book 2: Machine Learning: a Probabilistic Perspective by Kevin Patrick Murphy
- Book 3: Pattern Recognition and Machine Learning (Information Science and Statistics) by Christopher M. Bishop
- Book 4: Introduction to Machine Learning (Second Edition) by Ethem Alpaydın (published by The MIT Press Cambridge, Massachusetts London, England

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER I
ELECTIVE I : 1. NATURAL LANGUAGE PROCESSING

Teaching Scheme	**Examination Scheme**
Lectures : 3 Hours/Week, 3 Credits	**ESE – 70 Marks**
Tutorial : 1 Hour/Week, 1 Credit	**ISE – 30 Marks**
	ICA – 25 Marks

SECTION-I

Unit 1 Introduction **(7)**

Introduction to NLP, Machine Learning and NLP, Biology of Speech Processing; Place and Manner of Articulation, Word Boundary Detection, Arg-Max Computation, Lexical Knowledge Networks.

Unit 2 Word-net Theory **(7)**

Semantic Roles , Word Sense Disambiguation (WSD) : Word-Net, Word-net Application in Query Expansion, Wiktionary, semantic relatedness, Measures of Word-Net Similarity, Similarity Measures. Resnick's work on Word-Net Similarity, Indian Language Word-nets and Multilingual Dictionaries, Multi- linguality, Metaphors, Co references

Unit 3 Theories of Parsing **(7)**

Parsing Algorithms, Evidence for Deeper Structure, Top Down Parsing Algorithms, Noun Structure, Non-noun Structure and Parsing Algorithms, Robust and Scalable Parsing on Noisy Text as in Web documents Probabilistic parsing, Hybrid of Rule Based and Probabilistic Parsing sequence labeling, Training issues, Arguments and Adjuncts , inside- outside probabilities, Scope Ambiguity and Attachment Ambiguity
resolution.

SECTION-II

Unit 4 Speech **(7)**

Phonetics , HMM, Morphology, Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; M ximum Entropy Models; Random Fields.

Unit 5 Graphical Models **(7)**

Graphical Models for Sequence, Labelling in NLP, Consonants (place and manner of articulation) and Vowels , Forward Backward probability, Viterbi Algorithm

Unit 6 Semantic Relations **(7)**

UNL, Towards Dependency Parsing, Universal Networking Language, Semantic Role Extraction, Baum Welch Algorithm, HMM and Speech Recognition. HMM training, Baum Welch Algorithm; HMM training

Unit 7 Applications **(6)**

Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR).

Internal Continuous Assessment (ICA) :

It consists of minimum eight tutorials based upon each chapter of above curriculum. Tutorial shall include writing algorithms and implementing them.

Text Books:

1. Allen, James, “Natural Language Understanding”, Second Edition, Benjamin/Cumming, 1995.
2. Charniack, Eugene, “Statistical Language Learning”, MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.
4. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Reference Books:

1. Jurafsky, D., and Martin, J.H. (2008). “Speech and Language Processing” (2nd Edition). Upper Saddle River, NJ: Prentice Hall
2. Bird, S., Klein, E., Loper, E. (2009). “Natural Language Processing with Python”. Sebastopol, CA: O'Reilly Media.
3. Radford, Andrew et. al., “Linguistics, An Introduction”, Cambridge University Press, 1999.

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER I
ELECTIVE-I: 2. COMPUTER VISION

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/week	**ESE: 70 Marks**
Tutorials: 1 Hrs/week	**ISE: 30 Marks**
	ICA: 25 Marks

SECTION-I

Unit 1 **(8)**
Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis

Unit 2 **(8)**
Edge detection, Edge detection performance, Hough transform, corner detection

Unit 3 **(8)**
Segmentation, Morphological filtering, Fourier transform

SECTION-II

Unit 4 **(8)**
Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing

Unit 5 **(9)**
Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians
Classification: Discriminant Function, Supervised, Un-supervised, Semisupervised
Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.

Unit 6 **(4)**
Recent trends in Activity Recognition, computational photography, Biometrics.

Internal Continuous Assessment (ICA) :
ICA shall be based upon minimum 6 assignments based upon above curriculum

Reference Books :
1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Deep Learning, by Goodfellow, Bengio, and Courville.
3. Dictionary of Computer Vision and Image Processing, by Fisher et al.

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I

SEMESTER I

ELECTIVE-I: 3. SOFT COMPUTING

Teaching Scheme	**Examination Scheme**
Lectures:3 Hrs/week	**ESE: 70 Marks**
Tutorials: 1 Hrs/week	**ISE: 30 Marks**
	ICA: 25 Marks

SECTION-I

Unit 1 Introduction To Soft Comp uting **(5)**

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

Unit 2 Fuzzy Logic **(6)**

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Mak ing.

Unit 3 Neural Networks **(7)**

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

SECTION-II

Unit 4 Genetic Algorithms **(5)**

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learni -ng : Machine Learning Approach to Knowledge Acquisition.

Unit 5 Neuro-fuzzy modeling **(6)**

ANFIS, Coative Neuro-Fuzzy Modeling: Towards Generalized ANFIS. Advanced Neuro-Fuzzy modeling: classification and regression trees, data clustering algorithms, rule based structure identification.

Unit 6 Recent Trends **(5)**

Recent Trends‟ in deep learning, various classifiers, neural networks and genetic algorithm, Implementation of recently proposed soft computing techniques.

Internal Continuous Assessment (ICA) :

Minimum 8 Tutorials, on above mentioned chapters.

Text Books:

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing, Prentice Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall,1995.

References:

1. Neural Networks and Learning Machines by “Simon Haykin”3rd Edition, Phi Publication.
2. Rich E and Knight K, Artificial Intelligence, TMH, New Delhi.

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I

SEMESTER I

ELECTIVE-I: 4. OBJECT ORIENTED SOFTWARE ENGINEERING

Teaching Scheme	**Examination Scheme**
Lectures:3 Hrs/week	**ESE: 70 Marks**
Tutorials: 1 Hrs/week	**ISE: 30 Marks**
	ICA: 25 M

SECTION-I

Unit 1 Domain Model Engineering **(6)**

Crunching Knowledge, Communication and the Use of Language, Isolating the Domain, Model Expressed in Software, Life Cycle of a Domain Object, Maintaining Model Integrity.

Unit 2 Introduction to Primitive Workflows **(6)**

Unified Process: What is UML? What is the Unified Process? The requirements workflow, Use case modeling., The analysis workflow., Objects and classes, Finding analysis classes, Relationships, Inheritance and polymorphism, Activity diagrams, Design-driven Workflows: Activity diagrams, Design-driven Workflows: implementation workflow, Design-driven Workflows: The design workflow. Design classes, Refining Interfaces and components, State machines, advanced state machines, The i Deployment,

Unit 3 Introduction to Software Architecture (6)

Software Architecture, Relationships to Other Disciplines, Multi-Disciplinary Overview, Foundations of Software Architecture, Software architecture in the context of the overall software life cycle, Architectural Styles, CASE study of Architectures.

SECTION-II

Unit 4 Software Architecture Design **(6)**

Designing, Describing, and Using Software Architecture, IS2000: The Advanced Imaging Solution, Global Analysis, Software Architecture View: Conceptual Architecture View, Module Architecture View, Execution Architecture View, Code Architecture View. Component-and-Connector View type and styles, Allocation View type and Styles

Unit 5 Archetype Patterns **(6)**

Archetypes and Archetype Patterns, Model Driven Architecture with Archetype Patterns, Literate Modeling, Archetype Pattern., Customer Relationship Management (CRM) Archetype Pattern, Product Archetype Pattern, Quantity Archetype Pattern,

Unit 6 Design Patterns and Patterns Types **(6)**

Design Patterns: Creational Patterns, Patterns for Organization of Work, Access Control Patterns, Service Variation Patterns

Pattern Types: Object Management Patterns, Communication Patterns, Architectural Patterns, Structural Patterns, Patterns for Interactive Systems, Analysis Patterns

Advanced Patterns**:** Patterns for Concurrent and Networked Objects, Patterns for Distributed Computing.

Internal Continuous Assessment (ICA) :

1 A) To narrate Requirement Definition Document for the target system with following three areas:

- Problem Identification
- Problem Definition
- Problem Statement

B) To narrate System Requirements Specification Document for target system with reference to the IEEE 610.12.1990 std guidelines.

2) To decompose and organize the problem domain area into broad subject areas and identify the boundaries of problem/system. Specify the behavior of the target system and map requirements to Use cases. The System Context Diagram depicts the overall System behavioral trace and Requirement Capture diagram depicts the hierarchical Use Case Organization. The Use Case diagram should encompass
    a. Actors (External Users)
    b. Transactions (Use Cases)
    c. Event responses related to transactions with external agents.
    d. Detection of System boundaries indicating scope of system.
3) To depict the dynamic behavior of the target system using sequence diagram. The Sequence diagram should be based on the Scenarios generated by the inter-object communication. The model should depict:
    a. Discrete, distinguishable entities (class).
    b. Events (Individual stimulus from one object to another).
    c. Conditional events and relationship pre-presentation.
4) To depict the state transition with the life history of objects of a given class model. The model should depict:
    a. Possible ways the object can respond to events from other objects.
    b. Determine of start, end, and transition states.
5) To prepare Class Collaboration-Responsibility (CRC) cards for the Conceptual classes traced from System analysis phase. To develop logical static structure of target system with Class diagram. The model should depict
    a. Relationship between classes: inheritance, Assertion, Aggregation Instantiation
    b. Identification of objects and their purpose.
    c. Roles / responsibilities entities that determine system behavior.
6) To represent physical module that provides occurrence of classes or other logical elements identified during analysis and design of system using Component diagram. The model should depict allocation of classes to modules. To narrate the Program Design Language Constructs for the target system and implement the system according to specification.
7) Select a moderately complex system and narrate concise specification for the same. Implement the system features using Abstract Factory, Composite, Facade and Proxy design patterns. State the complete pattern specification and note the difference between the patterns.
8) Select a complex system and narrate concise specification for the same. Develop architecture specification and use archetypes to recognize the architectural elements.

Text Books

1. Christine Hofmeister, Robert Nord, Deli Soni, Addison-Wesley Professional; 1st edition Applied Software Architecture, (November 4, 1999), ISBN-10: 0201325713, ISBN-13:978-0201325713
2. Jim Arlow, Ila Neustadt, Addison-Wesley Professional, UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design, 2/E, ISBN-10: 0321321278, ISBN-13: 9780321321275,2005

Reference Books:

1. Frank Buschmann, Hans Rohnert, Kevin Henney, Douglas C. Schmidt,Pattern- Oriented Software Architecture Volume 1, 2, 3, 4, 5 by Publisher: Wiley; 1 edition (August 8, 1996-2004) ISBN-10: 0471958697 ISBN-13: 978-0471958697
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides Publisher: Addison- Wesley Professional; 1st edition Design Patterns: Elements of Reusable Object- Oriented Software (Addison-Wesley Professional Computing Series) (January 15, 1995) ISBN-10: 0201633612 ISBN-13:978-0201633610
3. Thomas Stahl, Markus Voelter, Krzysztof Czarnecki, Wiley, Model-Driven Software Development: Technology, Engineering, Management, ISBN-10: 0470025700, ISBN- 13: 978-04700257032006,
4. Eric Evans, Addison-Wesley Professional, Domain-Driven Design: Tackling Complexity in the Heart of Software, 2004, ISBN-10: 0321125215, ISBN-13: 9780321125217
5. Ian Gorton Springer; 1 edition (2006) Essential Software Architecture,ISBN-10: 3540287132 ISBN-13:978-3540287131
6. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Documenting Software Architectures, ISBN-13: 978-0321552686, ISBN-10: 0321552687
7. Jim Arlow; Ila Neustadt, Enterprise Patterns and MDA: Building Better Software with Archetype Patterns and UML, Publisher: Addison-Wesley Professional

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER II

1. Research Methodology and IPR

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Tutorial – 1 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION-I

Unit 1: Research fundamentals: (6)
Definition, objectives, motivation, types of research and approaches, researc h- descriptive, conceptual, theoretical, applied and experimental

Unit 2: The initial research process: (6)
Literature review, research design, assortment of the problem, identification of problem, defining a problem, objective, sub objective and scope, assumptions, validation criteria, research proposal(synopsis)

Unit 3: Report writing and presentation of results: (5)
Need, report structure, formulation, sections, protocols, graphs, tables, IEEE format, evaluation of report, writing abstract, writing technical paper

Unit 4: Information communication technology: (3)
Introduction, e-research, indices, virtual lab, digital lab, ethical issues in research

SECTION-II

Unit 5: Mathematical modeling and simulation: (7)
Mathematical modeling – need, techniques and classification, system models –types, static, dynamic, system simulation – why to simulate, technique of simulation, Monte Carlo simulation, types, continuous modeling, discrete model, Role of probability and statistics in simulation, statistical distributions,

Unit 6: Nature of Intellectual Property: **(7)**
Patents, designs, trade and copyright, process of patenting and development: technological research, innovation, patenting, development, international scenario: international cooperation on intellectual property, procedure for grants of patents, patenting under PCT.

Unit 7: Patent Rights: **(6)**
Scope of patent rights, licensing and transfer of technology, patent information and databases, geographical indications

Internal Continuous Assessment (ICA)
ICA shall be based upon minimum seven assignments based upon above syllabus

Reference Books

1. Fundamental of Research Methodology and Statistics, Yogesh Kumar Sing, New Age International Publishers
2. Research Methodology: Methods and Techniques, C.R. Kothari, New Age International Publishers, 2nd revised Edition
3. Research Methodology, Concepts and Cases, Deepak Chawla, NeenaSondhi, Vikas

4. Intellectual Propertyin New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016.
5. Intellectual Property Rights by Neeraj Pandey And KhushdeepDharn
6. Intellectual Property Rights Under WTO,T. Ramappa, S. Chand, 2008
7. Intellectual Property Rights Journal by CSIR-National institute of science Communication and Information Resources. (*January 2017 and March-May-2018*)

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER II
2. Internet of Things

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Practical – 2 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION I

Unit 1 : OVERVIEW OF IOT **(6)**

Introduction – Design Principles for connected Devices –Prototyping for embedded devices- Prototyping for Physical design, Characteristics of IoT, Sensor networks, Applications of IoT

Unit 2 : IOT ARCHITECTURE **(6)**

Node Structure - Sensing-Processing – Communication – Powering – Networking – Topologies - Layer/Stack architecture-IoT Standards-Cloud computing for IoT-Bluetooth-Bluetooth Low Energy-beacons.

Unit 3 : WIRELESS TECHNOLOGY FOR IOT **(7)**

WiFi (IEEE 802.11) - Bluetooth/Bluetooth Smart - ZigBee/ZigBee Smart - UWB (IEEE 802.15.4) - 6LoWPAN - Proprietary systems.

SECTION II

UNIT 4 : BUILDING IOT WITH RASPBERRY PI **(6)**

RASPBERRY PI: Physical device - Raspberry Pi Interfaces – Programming- APIs / Packages-Web services

Unit 5 : Database implementation for IoT : **(7)**

Cloud based IoT platforms, SQL vsNoSQL, Open sourced vs. Licensed Database, Available M2M cloud platform, AxedaXively, Omega NovoTech, Ayla Libellium, CISCO M2M platform, AT &T M2M platform, Google M2M platform.

Unit 6: Case Studies **(6)**

Home Automation-smart cities-Smart Grid- Electric vehicle charging- Environment- Agriculture-Productivity Applications

Internal Continuous Assessment (ICA) :

1) Introduction to the Internet of Things and Embedded Systems
2) *The Arduino Platform and C Programming*
3) *Interfacing with the Arduino*
4) *The Raspberry Pi Platform and Python Programming for the Raspberry Pi*
5) *Interfacing with the Raspberry Pi*
6) *Programming for the Internet of Things Project*
7) *Build IOT project for weather forecast/smart city / transportation /environmental/shopping application / for health care application and read data from sensor node*

Text Books:

1. Adrian McEwen and Hakim Cassimally“ Designing the Internet of Things “Wiley,2014. (UNIT I &V)
2. Oliver Hersent , David Boswarthick and Omar Elloumi “ The Internet of Things”, Wiley,2016 (UNIT II, III & UNIT V)
3. Peter Waher, “Learning Internet of Things”, Packt Publishing, 2015(UNIT IV)
4. Iot-Enabled Applications Third Edition, by Gerardus Blokdyk(Author)

Reference Books:

1. Jean-Philippe Vasseur, Adam Dunkels, “Interconnecting Smart Objects with IP: TheNextInternet” Morgan Kuffmann Publishers, 2010
2. ArshdeepBahga and VijaiMadisetti :A Hands-on Approach“Internet of Things”,UniversitiesPress 2015.
3. Samuel Greengard,“ The Internet of Things”, The MIT press, 2015
4. OvidiuVermesan and Peter Friess (Editors), “Internet of hings: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers Series in Communication,2013
5. https://www.coursera.org/specializations/iot

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER II

3. Internet Routing Algorithm

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Practical – 2 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION I

Unit 1 : Network Basics **(7)**

OSI Model, Network Hardware, Transmission media, Bridge, Router , Gateways, Network Software Components, MAC, Data Link Protocols, Switching Techniques TCP/IP Protocol suite.

Unit 2 : Networking and Network Routing **(7)**

Addressing and Internet Service: An Overview, Network Routing, IP Addressing, Service Architecture, Protocol Stack Architecture, Router Architecture, Network, Topology, Architecture, Network Management Architecture, Public Switched Telephone Network

Unit 3 : Routing Algorithms **(6)**

Shortest Path and Widest Path: Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra,,s Algorithm, Widest Path Algorithm, Dijkstra-Based Approach, Bellman–FordBased Approach, k-Shortest Paths Algorithm. OSPF and Integrated IS-IS : OSPF: Protocol Features, OSPF Packet Format, Integrated ISIS, Key Features, comparison BGP : Features ,Operations, Configuration Initialization, phases, Message Format. IP Routing and Distance Vector Protocol Family :RIPv1 and RIPv2

SECTION II

Unit 4 : Routing Protocols **(6)**

Framework and Principles Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing, Protocol, Link Cost.

Unit 5 : Internet Routing and Router Architectures **(6)**

Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy-Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability. Router Architectures: Functions, Types, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures

Unit 6 : Analysis of Network Algorithms **(6)**

Network Bottleneck, Network Algorithmics, Strawman solutions, Thinking Algorithmically, Refining the Algorithm, Cleaning up, Characteristics of Network Algorithms. IP Address Lookup Algorithms : Impact, Address Aggregation, Longest Prefix Matching, Naïve Algorithms, Binary , Multibit and Compressing Multibit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches IP Packet Filtering and Classification : Classification, Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for d Dimensions,

Internal Continuous Assessment (ICA) :

1. Network Routing – An Introduction through Implementation a. To setup Intranet : Installation and Configuration of Peer to Peer and Client Server models, Web server, E-mail, Proxy, Firewall and DNS Configurations b. Conversion of a simple machine into a router.
2. Routing Algorithms a. Bellman–Ford Algorithm and the Distance Vector Approach b. Comparison of the Bellman–Ford Algorithm and Dijkstra,,s Algorithm c. Shortest and Widest Path Computations
3. Routing Protocols a. Distance Vector Routing b. Link State Routing
4. Routing in IP networks a. RIP b. OSPF c. BGP
5. Internet Architecture a. Address Assignment b. Traffic Engineering c. Policy-Based Routing
6. Router Architectures a. Routing Functions b. Packet Processing
7. IP Address Lookup Algorithms
8. IP Packet Filtering and Classification
9. Quality of Service Routing

Text Books:

1. Network Algorithmics: An Interdisciplinary Approach to Designing Fast Networked Devices George Varghese (Morgan Kaufmann Series in Networking)

Reference Book :

1. Network Routing: Algorithms, Protocols, and Architectures DeepankarMedhi and KarthikeyanRamasamy (Morgan Kaufmann Series in Networking)

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER II

Elective – II 1. DEEP LEARNING

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Practical – 2 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

Course Prerequisite:

A basic course in Artificial Intelligence, Machine Learning, Theory of computation and parsers.

Course Objectives:

1. To learn the fundamentals of Neural Network.
2. To gain an in-depth understanding of training Deep Neural Networks.
3. To acquire knowledge of advanced concepts of Convolution Neural Networks, Autoencoders and Recurrent Neural Networks.
4. Students should be familiar with the recent trends in Deep Learning.

Course Outcomes:

After successful completion of the course student will be able to:

1. Gain basic knowledge of Neural Networks.
2. Acquire in depth understanding of training Deep Neural Networks.
3. Design appropriate DNN model for supervised, unsupervised and sequence learning applications.
4. Gain familiarity with recent trends and applications of Deep Learning.

SECTION – I

Unit 1-Fundamentals of Neural Network **(05)**

Biological neuron, Mc-Culloch Pitts Neuron, Perceptron, Perceptron Learning, Delta learning, Multilayer Perceptron: Linearly separable, linearly non-separable classes, Deep Networks: Fundamentals, Brief History, and Three Classes of Deep Learning Basic Terminologies of Deep Learning

Unit 2 - Introduction to Deep learning **(05)**

Introduction to Deep Feed forward Networks, Gradient Based Learning, Hidden Units Architecture-Design, Back propagation Algorithm

Unit 3 – Regularization and Optimization Techniques **(08)**

Regularization: Need of Regularization, L2 Regularization, L1 Regularization, Early Stopping and Dropout,

Optimization: Challenges in NN Optimization, Gradient Descent Approaches, Parameter Initialization Approach, Adaptive Approaches - AdaGrad, RMSProp and Adam, Introduction to Batch Normalization

SECTION – II

Unit 4– Evolution of CNN in Deep Learning **(08)**

Review of CNN Architecture, Introduction of various CNN Architectures: LeNet, AlexNet, VGG, GoogleNet, ResNet and UNet, Comparison of CNN Architectures, Evaluation Parameters, Applications of CNN in Image Classification and Object Detection

Unit 5- Autoencoders: Unsupervised Learning **(08)**

Introduction, Linear Autoencoder, Undercomplete Autoencoder, Overcomplete Autoencoders, Regularization in Autoencoders, Denoising Autoencoders, Sparse Autoencoders, Contractive Autoencoders, Application of Autoencoders: Image Compression

Unit 6 – Sequence Modeling **(08)**

Recurrent and Recursive Nets: Recurrent Neural Networks, Bidirectional RNN, Encoder Decoder Architectures, Introduction to Long Short-Term Memory (LSTM) and Temporal Dependencies, Gated Recurrent Units (GRUs), Applications of RNN in Real World- Image Captioning and Time Series Forecasting and Prediction3

Unit 7 – Recent Trends and Applications **(04)**

Encoder-Decoder Models, Generative Adversarial Network (GAN): Architecture, Applications: Image Generation, DeepFake

Internal Continuous Assessment (ICA):

Minimum 8 assignments and 8 practical based on above topics.

Text Books:

1. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer International Publishing, 2018.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
3. Li Deng and Dong Yu, ―Deep Learning Methods and Applications‖, Publishers Inc

Reference books

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer-Verlag, 2006.
2. Duda, Richard, Peter Hart, and David Stork, Pattern Classification, 2nd edition, Wiley-Interscience, 2000.
3. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
4. Reza Zadeh, Bharath Ramsundar, TensorFlow for Deep Learning, 1st edition, O'Reilly Media Inc, 2018.
5. Zaccone, Giancarlo, Deep Learning with TensorFlow, 2nd edition, Packt Publishing, 2018.

Useful Links

1. https://nptel.ac.
2. https://deeplearning.cs.cmu.edu/S21/index.html
3. http://www.cse.iitm.ac.in/~miteshk/CS6910.html
4. https://nptel.ac.in/courses/106/106/106106184/
5. https://www.deeplearningbook.org/
6. https://www.analyticsvidhya.com/blog/2021/10/an-end-to-end-introduction-to-generative-adversarial-networksgans/

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER II
Elective – II 2. Advanced Cloud Computing

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Practical – 2 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION I

Unit-I **(7)**

Overview of Computing Paradigm: Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Co puting, Cloud Computing. Evolution of cloud computing: Business driver for adopting cloud computing.
Introduction to Cloud Computing :Cloud Computing (NIST Model): Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers; Properties, Characteristics & Disadvantages: Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing; Role of Open Standards

Unit-II **(6)**

Cloud Computing Architecture: Cloud computing stack: Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Web services; Service Models (XaaS): Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS); Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud.

Unit-III **(7)**

Infrastructure as a Service (IaaS): Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM).
Resource Virtualization: Server, Storage, Network, Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service); Examples: Amazon EC2, Renting, EC2 Compute Unit, Platform and Storage, pricing, customers, Eucalyptus.

SECTION II

Unit IV **(7)**

Platform as a Service(PaaS):Introduction to PaaS: What is PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management, Computation, Storage, Examples, Google App Engine, Microsoft Azure, SalesForce.com‟s Force.com platfor .

Unit-V **(7)**

Software as a Service(PaaS):Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS. Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data, Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing.

Unit-VI **(7)**

Cloud Security: Network level security, Host level security, Application level security, Data security and Storage: Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business

Internal Continuous Assessment (ICA) :

ICA shall be based upon 6 to 8 assignments based upon above syllabus.

Reference Books

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing Principals and Paradigms : Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
3. Cloud Computing: Principles, Applications, Editors: Nikos Systems and Antonopoulos, Lee Gillam, Springer, 2012
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I

SEMESTER II

Elective – II 3. High Performance Computing

Teaching Scheme

Lectures – 3 Hours/week, 3 Credits
Practical – 2 Hour/week, 1 Credit

Examination Scheme

ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION I

Unit 1 : Introduction to Parallel Processing (7)

Levels of Parallelism (instruction, transaction, task, thread, memory, and function), Models (SIMD, MIMD, SIMT, SPMD, Data Flow Models, Demand-driven Computation). HPC Platforms: Message-passing interface (MPI),Shared-memory thread-based OpenMP programs, hybrid(MPI/Open MP) programs, Grid Computing, Cloud Computing , Multi-Core Processors, accelerators, GPGPUs.

Unit 2 : Parallel Programs (8)

The Parallelization Process: Steps in the process, Parallelizing computation versus data, Goals of the Parallelization Process, Parallelization of an Example Program: The equation solver kernel, Decomposition, Assignment, Orchestration: under the data parallel model, under the shared address space model and under the message passing model.

Unit 3 : Parallel Models, Languages and Compilers (8)

Parallel Programming Models: Shared Variable Model, Message Passing Model, Data Parallel Model, Object Oriented Model and Functional and Logic Models. Parallel Languages and Compilers: Language Features for Parallelism, Parallel Language Constructs ,Optimizing Compilers for Parallelism. Loop Parallelism and Pipelining: Loop transaction theory, Parallelization and wavefronting, Tiling and Localization and Software Pipelining.

SECTION II

Unit 4 : Parallel Program Development and Environment (7)

Parallel Programming Environments: Software tools and environments,Y-MP,Paragon and CM-5 Environment, Visualization and Performance Tuning.Synchronization and Multiprocessing Models: Principles of Synchronization, Multiprocessor Execution Models, Multitasking on Cray Multiprocessors. Shared Variable Program Structures: Lock for protected access, Semaphores and Applications, Monitors and Applications.

Unit 5 : Shared Memory Multiprocessor (8)

Cache Coherence: The Cache Coherence Problem, Cache Coherence through Bus Snooping. Memory Consistency: Sequential Consistency, Sufficient Conditions for Preserving Sequential Consistency. Synchronization: Components of a Synchronization event, Role of the user and Program, Mutual exclusion, Point to Point Event Synchronization, Global(Barrier) Event Synchronization.

Unit 6 : Interconnection Network Design (7)

Basic Communication Performance: Latency, Bandwidth. Organizational Structure: Links, Switches and Network Interface. Interconnection Topology: Fully connected network, Linear array and rings, Multidimensional Meshes and Tori, Trees, Butterflies and Hypercube. Routing: Routing Mechanisms, Deterministic Routing, Turn-Model Routing and Adaptive Routing.

Internal Continuous Assessment (ICA) :
Assignments: Minimum 6 assignments based on above topics.

Text Books:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar , “Introduction to Parallel Computing”, Pearson Education, Second Edition, 2007.
2. Kai Hwang, Naresh Jotwani, “Advanced Computer Architecture: Parallelism, Scalability, Programmability”, McGraw Hill, Second Edition, 2010.
3. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann,1999.

Reference Books:

1. Kai Hwang,, "Scalable Parallel Computing", McGraw Hill 1998.
2. George S. Almasi and Alan Gottlieb, "Highly Parallel Computing", The Benjamin and Cummings Pub. Co., Inc
3. Georg Hager, Gerhard Wellein, “Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.
4. Michael J. Quinn, “Parallel Programming in C with MPI and OpenMP”, McGraw-Hill International Editions, Computer Science Series, 2008.

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I

SEMESTER II

Elective – II 4. Software Defined Network

Teaching Scheme

Lectures – 3 Hours/week, 3 Credits
Practical – 2 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION-I

Unit 1 : Introduction to Networking **(6)**

OSI layers; TCP/IP Protocol Suite; Distance vector and link state routing algorithms, Network protocols (ARP, BGP, OSPF, RIP, ICMP) and network topologies.

Unit 2 : Introduction to SDN **(7)**

Overview; History and evolution of SDN; Architecture of SDN; SDN Flavours; Scalability (Data Centres, Service provider networks, ISP Automation); Reliability (QoS, and Service Availability); Consistency (Configuration management, and Access Control Violations); Opportunities and Challenges;

Unit 3 : Control and Data Plane Separation **(7)**

Introduction to OpenFlow; History and evolution; Control and data plane separation; virtual networking; Use-cases (Network Access Control, Virtual Customer Edge, Datacenter Optimization);

SECTION-II

Unit 4 : Network Virtualisation (7)

Abstraction of Physical Network (constrained forwarding model, distributed state, detailed configuration); components of a virtual network (Virtual Switch, Bridge, Host-virtual adapter, NAT device, DHCP server, Network adapter); Network as a Service (NaaS)

Unit 5 : Applications of SDN **(6)**

Network management; Resource utilization; Network service chaining; Bandwidth calendaring and Network programmability.

Unit 6 : SDN Design and Development **(7)**

Mininet; Applications; Network Virtual Machines; SDN Controller (POX, Floodlight, OpenDayLight; Applicability of OpenFlow protocols in SDN Controllers

Internal Continuous Assessment (ICA) :

Minimum 5-6 assignments on above mentioned syllabus.

Text Books

1. Ying-Dar Lin, Ren-Hung Hwang, and Fred Baker, “Computer Networks: An Open Source Approach”, McGraw-Hill Science/Engineering/Math, 2011.
2. Paul Goransson and Chuck Black, “Software Defined Networks: A Comprehensive Approach”, Morgan Kaufmann, 2014.

Reference Books

1. Siamak Azodolmolky, “Software Defined Networking with OpenFlow”, Packt Publishing, 2013
2. Kingston Smiler, “OpenFlow® Cookbook”, Packt Publishing, 2015
3. Doug Marschke, Jeff Doyle, Pete Moyer, “Software Defined Networking (SDN): Anatomy of OpenFlow® Volume I”. Lulu Publishing Services, 2015

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER II
Elective – III 1. Wireless Sensor Network

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Tutorial – 1 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION-I

Unit 1: Introduction to WSN **(8)**

Introduction to WSN, Basic Overvi ew of the Technology, Basic Sensor Network Architectural Elements, Brief Historical Survey of Sensor Networks, Challenges and Hurdles, Applications of Wireless Sensor Networks, Range of Applications, and Category 1 WSN Applications: Sensor and Robots, Reconfigurable Sensor Networks, Highway Monitoring, Wildfire Instrumentation, Nanoscopic Sensor Applications, Habitat Monitoring, Category 2 WSN Applications: Home Control, Building Automation, Industrial Automation, Medical Applications

Unit 2 : Basic Wireless Sensor Tec hnology **(8)**

Introduction, Sensor Node Technology, Hardware and Software, Sensor Taxonomy, WN Operating Environment, WN Trends, Introd uction to Wireless Transmission Technology and Systems, Radio Technology Primer, Propagation and Propagation Impairments, Modulation, Available Wireless Technologies, Campus Applications, MAN/WAN Applications

Unit 3: Factors Influencing WSN Design **(4)**

Hardware Constraints, Fault Tolerance, Scalability, Production Costs, WSN Topology: Pre-deployment and Deployment Phase, Post-deployment Phase, Re-deployment Phase of Additional Nodes, Transmission Media , Power Consumption, Sensing , Data Processing , Communication

SECTION-II

Unit 4 : Physical layer **(6)**

Introduction to Wireless channel and communication fundamentals :Frequency allocation , Modulation and demodulation, Wave propagation effects and noise, Channel models, Spread-spectrum communications, Packet transmission and synchronization, Quality of wireless channels and measures for improvement, Physical layer and transceiver design considerations in WSNs: Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations

Unit 5 : MAC protocols and Link-layer protocols **(4)**

Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, The IEEE 802.15.4 MAC prot ocol, Link-layer protocols :Fundamentals: tasks and requirements, Error control, Framing, Link management

Unit 6 : Network Layer and Transport Layer **(8)**

Challenges for Routing, Data-centric and Flat-Architecture Protocols, Hierarchical Protocols, Geographical Routing Protocols, QoS-Based Protocols Transport Layer, Challenges for Transport Layer, Reliable Multi-Segment Transport (RMST) Protocol, Pump Slowly, Fetch Quickly (PSFQ) Protocol, Congestion Detection and Avoidance (CODA) Protocol, Event-to-Sink Reliable Transport (ESRT) Protocol, GARUDA, Real-Time and Reliable Transport Protocol

Internal Continuous Assessment (ICA) :
Minimum 5-6 assignments on above mentioned syllabus.

Text Books:

1. Protocols & Architectures for Wireless Sensor Networks by Holger Karl, Andreas Willig, Wiley, 2005
2. Wireless Sensor Networks: Technology, Protocols, and Applications by Kazem Sohraby, Daniel Minoli, Taieb Znati
3. Wireless Sensor Networks by Ian F. Akyildiz, Mehmet Can Vuran, A John Wiley and Sons, Ltd, Publication

Reference Books:

1 Wireless sensor networks Edited by C. S. Raghavendra Pub: Springer
2 Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks : Theory and Applications", Second Edition, World Scientific Publishers, 2011
3 Jagannathan Sarangapani, Wireless Ad hoc and Sensor Networks: Protocols, Performance, and Control, CRC Press, 2007

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER II
Elective – III 2. Infrastructure Management

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Tutorial – 1 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION I

Unit 1: Infrastructure Management Overview **(6)**

Definitions, Infrastructure management activities, Evolutions of Systems from Mainframes -to-New age systems and their management, growth of internet, current business demands and IT systems issues, Complexity of today,,s computing environment, cost estimation of complexity issues, Importance of Systems management for enterprises.

Unit 2: Preparing for Infrastructure Management **(7)**

IT infrastructure design factors and considerations, Determining customer,,s Requirements, Identifying System Components to manage- processes, data and applications. Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL)

Unit 3: Service Delivery Processes **(7)**

Service level management, financial management and costing, IT services continuity management, Capacity management, Availability management.

SECTION II

Unit 4: Service Support and Management Processes **(7)**

Configuration Management, Service desk, Incident management, Problem management, Change management, Release management

Unit 5: Storage and Security Management **(6)**

Introduction to storage, Backup & Restore, Archive & Retrieve, Space management, SAN & NAS, Disaster Recovery, Database & Application protection, Data retention, Introduction Security, Identity management, Single sign-on, Access Management, Basics of network security, Firewalls.

Unit 6: Issues in Infrastructure management **(7)**

Regulatory issues in infrastructure management, Environmental policies, Urban governance Rural IT infrastructure management, Technology change management in infrastructure sectors

Internal Continuous Assessment (ICA) :

1. Infrastructure Management activities and importance in Enterprises.
2. Design factors in IT infrastructure management.
3. Information Technology Infrastructure Library (ITIL)
4. Service Delivery Processes
5. Service Support Processes
6. Storage management in IT infrastructure management
7. Security management in IT infrastructure management
8. Current trends and issues in IT infrastructure management

Text Books:

1. Foundation of IT Service Management: base on ITIL, by Jan Van Bon, Van Haren publishing, 2nd edition 2005.
2. High Availability: Design, Techniques, and processe, by Floyd Piedad, MachaelHawkins, Prentice Hall, 2000

Reference Books:

1. IT Oraganization: Building a Worldclass Infrastracture, by Harris Kern, Stuart Galup, Guy Nemiro, Publisher: Prentice Hall, 2000
2. IT Systems Management: Designing, Implimenting, and managing World – class Infrastractures Rich Schiesser, Prentice Hall PTR; 2001
3. Grigg, Nail, ―Infrastructure Engineering and management‖, John Wiley, 1998.

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER II
Elective – III 3. Real Time Operating System

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Tutorial – 1 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION-I

Unit 1 : Fundamentals of Real-Time Systems **(5)**
Concepts and Misconceptions, Multidisciplinary Design Challenges, Birth and Evolution of Real-Time Systems, Basic Processor Architecture, Memory Technologies

Unit 2 : Real Time Operating Systems **(6)**
From Pseudo kernels to Operating systems, Theoretical Foundations of Scheduling, System services for Application Programs, Memory Management Issues, Selecting Real Time Operating systems

Unit 3 : Programming Languages for Real Time Systems **(7)**
Coding of Real-Time Software, Assembly Language, Procedural Languages, Object-oriented languages, Overview of Programming Languages, Automatic Code Generation, Compiler Optimizations of Code

SECTION-II

Unit 4 : Requirement Engineering Methodologies **(7)**
Requirements Engineering for Real-Time systems, Formal methods in system specification, Semiformal methods in system specification, The requirements Document

Unit 5 : Software Design Approaches **(6)**
Qualities of Real-Time Software, Software Engineering Principles, Procedural Design Approach, Object-Oriented design approach, Life cycle models

Unit 6 : Performance Analysis Techniques **(5)**
Real-Time Performance Analysis, Applications of Queuing Theory, Input/Output Performance, Analysis of Memory Requirements

Internal Continuous Assessment (ICA) :
Minimum 5-6 Tutorials, on above mentioned chapters.

Text Books:

1. Real-Time Systems Design and Analysis: Tools for the Practitioner, Phillip Laplante, Seppo Ovaska (Fourth Edition, Wiley Publication)
2. Real-Time Systems Design and Analysis, Phillip Laplante (Third Edition, Wiley Publication)

Reference Books :

1. Building a Real Time Operating system: Colin Walls
2. Real Time Systems Development: Rob Williams

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER II
Elective – III 4. Advances in Database System

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Tutorial – 1 Hour/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

SECTION I

Unit 1 **(8)**

Physical database design & Tuning Database workloads, physical design and tuning decisions, Need for Tuning Index selection: Guideline for index selection, Clustering & Indexing Tools for index selection Database Tuning: Tuning indexes, Tuning Conceptual schema Tuning Queries &views, Impact of Concurrency, Benchmarking

Unit 2 **(6)**

Distributed Databases Introduction, Design Framework, Design of database fragmentation, The Allocation of Fragments, Translation of global queries to fragment queries, Optimization of access queries, Distributed Transaction Management, Concurrency Control, Reliability.

Unit 3 **(8)**

Advance Transaction Processing Transaction Processing Monitors, Transactional Workflow, Real time transaction System, Long duration Transactions, Transaction Management in Multi-databases, Distributed Transaction Management, Main Memory Databases, and Advanced Transaction Models.

SECTION II

Unit 4 **(8)**

Semi-Structured Data and XML Semi-Structured Data, Introduction to XML, Components of XML, XML schemas & DTD, Parsing XML, Xpath, XSLT, XQuery, Storage of XML data
XML Technologies & Application: DOM & SAX Interfaces, XHTML, SOAP, WSDL, UDDI, XML database Application.

Unit 5 **(6)**

Emerging Trends in Databases: Temporal databases, Spatial & geographic databases, Multimedia Databases, Mobile Databases

Unit 6 **(8)**

Large-scale Data Management with HADOOP, Semi structured database COUCHDB: Introduction, Architecture and principles, features

Internal Continuous Assessment (ICA) :
Minimum 5-6 assignments on above mentioned syllabus.

Text Books :

1. Database system Concept by Silberschatz and Korth 6th Edition
2. Database Management System - Ramakrishna Gherkin (McGraw Hill)
3. Distributed Database Principals and systems - Stephan ceri, Giuseppe Pelagatti. (McGraw Hill

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEEING)
Four Semester Course
Choice Based Credit System Syllabus
Semester-III

1. Self Learning Course – Big Data

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits

Examination Scheme
ISE: 30 marks
ESE: 70 marks

SECTION-I

Unit 1: Introduction to Big Data Analytics: Introduction and importance of Big Data, Fundamentals, Examining Big Data types, Characteristics.

Unit 2 Technology Foundation of Big Data: Big Data Technology, Digging into Big Data Technology components , Virtualization and Big Data ,Examining Cloud and Big Data, Information Management in Big Data.

Unit 3: Big Data Management: Operational Databases, MapReduce Fundamentals, Exploringworld of Hadoop , Hadoop Foundation and ecosystem , Appliances and Big Data Warehouses.

SECTION II

Unit 4: The MapReduce and Software Stack: Algorithms using MapReduce, Extensions to MapReduce,The communication Cost Model, The Complexity Theory for MapReduce.

Unit 5: Big Data Solutions in Real World: The importance of Bigdata to Business, Analyzing Datain Motion: A Real-World View, Improving Business Processes with Big Data Analytics:A Real-World View, Data Privacy and Ethics in Big Data.

Unit 6: Ethics of Big Data: Big Data Big Impact, Values and Actions, Current practices, Aligning Values and Actions.

Text books:

1. Big Data For Dummies By Judith Hurwitz, Alan Nugent , Fern Halper , Marcia Kaufman : John Wiley & Sons
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses (Wiley CIO) By Michael Minelli, Michele Chambers, Ambiga Dhiraj : John Wiley & Sons
3. Ethics of Big Data: Balancing Risk and Innovation By Kord Davis, O'reilly Media
4. Mining of Massive Datasets by Anand Rajaraman, Jure Leskovec, Je□ rey D. Ullman, Cambridge University Press.

Reference Books:

1. Hadoop: The Definitive Guide, 3rd Edition , By Tom White , O'reilly Media
2. Big Data Now: 2012 Edition Publisher: O'Reilly Media.
3. Too Big to Ignore: The Business Case for Big Data (Wiley and SAS Business Series) By Phil Simon, Wiley 1e.

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEEING)
Four Semester Course
Choice Based Credit System Syllabus
Semester-III

2. Self Learning Course – Computer Network Administration

Teaching Scheme	**Examination Scheme**
Lectures – 3 Hours/week, 3 Credits	**ISE: 30 marks**
	ESE: 70 marks

SECTION-I

1. Data Communication and network management overview:
Analogy of telephone network management, Data and telecommunication network, distributed computing environment, TCP/IP based networks – Internet and intranet, communication protocols and standards, challenges of information technology manager Network management – goals, organization and functions, network and system management, network management system platform, current status and future of network management.

2. Basic foundation:
Standards, models and languages: Network management standards, network management model, organization model, information model, communication model, ASN.1, Encoding structure, macros, and functional model.

3. SNMP 1 network management:
Organization and information models: Managed network, International organization and standard SNMP model, organization model, system overview, information models

Section II

4. SNMP v1 network management:
Communication and functional models, SNMP model, functional model, Major changes in SNMP v2and v3

5. SNMP Management:
RMON – Remote monitoring, RMON, SMI & MIB, RMON1, RMOPN2, ATM Remote monitoring,case study of internet traffic using RMON.

6. Network management tools and systems:
Network management tools, network statistics measurement systems, network management systems, commercial network management systems, System management, Enterprise management solutions.

Text Books:

1. Network Management principles and practice – Mani Subramanian (Pearson Edition)
2. SNMP – SNMPv2 , SNMPv3 & RMON 1 – William Stalling (Pearson Edition)
3. Network Administration – Steve Wisniewski.

Reference Books:

1. Network Management – Concepts & Practice: A Hands-on Approach by J. Richard Burke (Pearson Education)
2. Network Management, MIBs & MPLS, Principles, Design & Implementation/Stephen B. Morris (Pearson Education).
3. TCP/IP Protocol Suite – B.A. Forouzan (TMH Edition)

P A H SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING)
Four Semester Course
Choice Based Credit System

Semester-III

3.Self Learning Course – Open Source Technologies

Teaching Scheme	Examination Scheme
Lectures – 3 Hours/week, 3 Credits	ISE: 30 marks
	ESE: 70 marks

SECTION – I

Unit 1 OST (Open Source Technologies) Overview: Evolution & development of OST and contemporary technologies, Factors leading to its growth. Open Source Initiative (OSI), Free Software Foundation and the GNU Project, principle and methodologies, Indian Contexts of OST, Applications, Pros and cons of OST.

Unit 2 Open Source Licenses: The MIT License, The BSD License, The Apache License, v1.1 and v2.0, The Academic Free License , Application and Philosophy of MIT and BSD Licenses, GNU General Public License, GNU Lesser General Public License, The Mozilla Public License, Application and Philosophy of GNU GPL and GNU LGPL, Artistic and Creative Commons Licenses

Unit 3 Legal Impacts of Open Source Technologies: Entering Contracts, Statutory Developments Related to Software Contracts, The Self-Enforcing Nature of Open Source and Free Software Licenses, The Global Scope of Open Source and Free Software Licensing, Community Enforcement of Open Source and Free Software Licenses, Compatible and Incompatible Licensing: Multiple and Cross Licensing.

SECTION- II

Unit 4 Introduction of Linux: Overview of Linux Operating System, Linux Distribution, Graphical Environment and Terminal Windows, Linux Graphical Desktop , File System Concepts, Managing File with Graphical Utilities. Linux OS variants, Case study of Ubuntu 12.04.x and BOSS (Bharat Operating System Solutions) Linux.

Unit 5 Open Source Web servers and RDBMS:
Open Source Web servers: Installation, configuration and administration under Windows and Linuxenvironment: of Apache, Nginx, Apache Tomcat.
Open Source RDBMS: Installation, configuration and administration under Windows and Linux environment: MySQL, PostgreSQL.

Unit 6 Popular Open Source Softwares: Installation, customization and maintenance of Open Source Content management Systems: Drupal, Wordpress , Joomla , Umbraco , Liferay Portal, Alfresco. Installation, Customization and Maintenance of Open Source Learning management Systems: Moodle, ATutor.

Textbooks:

1. Understanding Open Source and Free Software Licensing - By Andrew M. St. Laurent, Oreily Media. (e-Resource available at: http://oreilly.com/openbook/osfreesoft/book/index.html)
2. Apache HTTP Server Documentation Version 2.2 by by Apache Software Foundation
3. MySQL 5.5 Reference Manual (Chapter 2 and 3 of manual) (e-Resource)
4. The Complete Guide to Linux System Administration by Nicholas Wells, Cengage Learning.
5. Official Documentation of ATutor, Moodle, Drupal, Joomla, Wordpress, Liferay Portal, Alfresco, Umbraco. (e-Resources)

Reference Books:

1. BOSS Linux: http://bosslinux.in
2. (NRCFOSS) initiative of the Department of Information Technology, Ministry of Communications & Information Technology, Government of India, http://www.nrcfoss.org.in/
3. Open Source: Technology and Policy By Fadi P. Deek and James A. M. McHugh , Cambridge University Press

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING)

Four Semester Course

Choice Based Credit

SystemSemester-III

4.Self Learning Course – Usability Engineering

Teaching Scheme	Examination Scheme
Lectures – 3 Hours/week, 3 Credits	ISE: 30 marks
	ESE: 70 marks

SECTION- I

Unit – 1 Usability - Introduction

What is Usability? benefits and cost savings, usability slogans, attributes of system acceptability, definition of usability, usability trade-Offs , categories of users and individual user differences, generations of user interfaces, scenario-based usability engineering case study - A Virtual Science Fair.

Unit – 2 The Usability Engineering Lifecycle

User research and requirements analysis - know the user, user-profile questionnaire, field-study methods, contextual inquiry and analysis, hierarchical task analysis, ethnography, cultural probe, affinity diagramming, persona, scenarios of use, use cases.

Iterative Design - setting usability criteria or goals, participatory design (getting users involved), guidelines and heuristic evaluation, prototyping and scenarios , examples of problem scenarios, iterative design, interface evaluation, meta methods.

Unit – 3 Information Design and Interaction Design

Information design - Information architecture concepts, stages of action in human-computer interaction, perceiving information, interpreting information, making sense of information.

Interaction Design - selecting system goal, planning action sequence, executing action sequence, case study of information and interaction design

User Interface Design - Goals of UID, User Interface Models , conceptual model and mock-ups of GUI, choosing prototyping alternatives - paper prototyping, rapid prototyping, storyboarding, wireframes, Cost/benefit of good interface design , Case Study.

SECTION- II

Unit – 4 Usability Evaluation

Developing usability specifications for evaluation - case study, criteria for user feedback techniques, formative and summative techniques of evaluation

Usability Inspections (testing without users) - heuristic evaluation, user-interface guideline reviews, cognitive walkthrough, model-based analysis

Usability Testing (testing with users) - developing usability or test specifications with case study, test goals and test plans , getting test users, choosing experimenters, ethical aspects of tests with human subjects, test tasks, stages of a test, performance measurement, thinking-aloud testing, usability

laboratories, remote evaluation
Methods beyond testing - observation, user satisfaction questionnaire (rating scale), interviews, system usability scale (SUS), focus groups, logging actual use, user feedback, choosing a methods.

Unit – 5 User-Interface and Usability Standards
User benefits, vendor benefits, dangers of standards, principles of good UI design, national-international standards, internationalization - international GUI, guidelines for internationalization, localization and multilocale interfaces, UI standards - control standards, window standards, dialog box standards, message box standards, device interaction standards, feedback standards, developing style guides and toolkits , user documentation- manuals, tutorials, information in the interface.

Unit – 6 Recent Advances And Trends
Theoretical solutions, technological solutions, CAUSE tools, emerging paradigms of user interaction- collaborative systems, ubiquitous computing , intelligent user-interfaces, simulation and virtual reality, case study , usability issues in organizations- case studies , organizational roles and structures, ethics of usability, web analytics.

Text Books

1. Nielsen, J. (1994), "Usability Engineering", Elsevier.
2. Rosson, M. B., & Carroll, J. M. (2001), " Usability Engineering: Scenario-Based development ofhuman-computer interaction", Elsevier.
3. Mayhew, D. (1999), "The Usability Engineering Lifecycle: A Practitioner's Handbook for userinterface design", Morgan Kaufmann

Reference Books

1. Cooper A. et. al. (2007), " The Essentials of Interaction Design", Wiley
2. Cooper, A. (1995)," The Essentials of User Interface Design", IDG Books, New Delhi
3. Schneiderman, B. (2005), " Designing the User Interface", Pearson Education, New Delhi
4. Dix A. et. al.(1993), " Human - Computer Interaction", Prentice Hall, USA
5. Mandel, T. , " Elements of User Interface Design", John Wiley & Sons
6. Rogers et. al (2011), " Interaction Design", John Wiley & Sons
7. Norman, D. (1988), "The Design of Everyday Things", Basic Books.
8. Donna Spencer<, "A Practical Guide to Information Architecture"
9. Galitz, W. (2002), "The Essential Guide To User Interface Design", Wiley.

Web-links
1. http://www.usabilitybok.org/
2. http://www.usability.gov/
3. http://www.webmonkey.com/2010/02/information_architecture_tutorial/
4. http://www.measuringu.com/
5. http://user.medunigraz.at/andreas.holzinger/holzinger%20de/usability%20holzinger.html

Mode of Assessment

(i) Assessment of Theory Courses: (Self Learning Course)

(a) A student shall be evaluated with 30% weightage for his/her academic performance in a theory course for In-Semester Evaluation (ISE) and with 70% weightage for End-Semester Examination (ESE) which is University Examination.

(b) ISE shall be based on student's performance in Mid-term tests, Class-tests, assignments, viva-voce, quizzes, subject seminars, field visit, case studies, subject mini project etc. The mode of In-Semester Evaluation (ISE) shall be decided from various assessment components mentioned in

Table-A given hereunder and the same shall be announced by the Course Instructor at the beginningof the course.

In-Semester Evaluation is a process of continuous assessment. The formative and summative assessment components are combined to generate 30% weightage marks for In-Semester Evaluation (ISE).

Table – A: Assessment components

Sr. No.	**Assessment Component**	**Max. Marks**
1	Mid-Term Written Test conducted & evaluated at Institute Level (Mandatory)	**15**
2	Written Test conducted & evaluated at Institute Level **or** One or more Appropriate Activities related to course curriculum and conducted & evaluated at institute level, which includes–, assignments, viva-voce, quizzes, subject seminars with report writing, field visit, subject mini project, application software training, case study with report writing.	**15** **15**

(c) ESE shall be University Examination of three hours duration for each theory course carrying 70% weightage and shall be held as per the schedule declared by the university for that semester.

(d) All examinations and evaluations shall be compulsory. Credits for a course shall be awarded only if the student satisfies evaluation criteria and acquire the necessary minimum grade.

(e) Minimum performance of 40% in ISE and ESE **separately** shall be required to get the passing grade.

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING)

Semester-III

2. Open Elective Course- i. Business Analytics

Teaching Scheme
Lectures - 3 Hours/week, 3 Credits

Examination Scheme
ESE- 70 Marks
ISE- 30 Marks

SECTION-I

Unit 1: Introduction **(04)**

What Is Business Analytics? Business Analytics Process, Relation of BA process and Organizationdecision making process

What is Data Mining? Data Mining and Related Terms, Big Data, Data Science, Terminology andNotation in Data mining

Unit 2: Overview of the Data Mining Process **(05)**

Core Ideas in Data Mining, Classification, Prediction, Association Rules and Recommendation Systems, Predictive Analytics, Data Reduction and Dimension Reduction, Data Exploration and Visualization, Supervised and Unsupervised Learning, Steps in Data Mining, Organization of Data sets

Unit 3: Data Visualization **(05)**

Uses of Data Visualization, Basic Charts: Bar Charts, Line Graphs, and Scatter Plots, Distribution Plots: Box plots and Histograms, Heat maps: Visualizing Correlations and Missing Values Multidimensional Visualization: Adding Variables: Color, Size, Shape, Multiple Panels, and Animation

Manipulations: Rescaling, Aggregation and Hierarchies, Zooming, Filtering, Reference: Trend Lines and Labels, Scaling up to Large Datasets

Unit 4: Dimension Reduction **(04)**

Introduction, Curse of Dimensionality, Data Summaries, Summary Statistics, Aggregation and Pivot Tables, Correlation Analysis, Reducing the Number of Categories in Categorical Variables, Converting a Categorical Variable to a Numerical Variable, Principal Components Analysis

SECTION-II

Unit 5: Performance Evaluation **(05)**

Evaluating Predictive Performance, Naive Benchmark: The Average, Prediction Accuracy Measures Comparing Training and Validation Performance, Lift Chart, Judging Classifier Performance, Benchmark: The Naive Rule, Class Separation, The Confusion (Classification) Matrix, Using the Validation Data, Accuracy Measures

Unit 6: Multiple Linear Regression **(04)**

Explanatory vs. Predictive Modeling, Estimating the Regression Equation and Prediction, Variable Selection in Linear Regression, Reducing the Number of Predictors

Unit 7: Classification & Regression Trees **(05)**

Introduction, Classification Trees, Recursive Partitioning, Measures of Impurity, Tree Structure, Classifying a New Record, Evaluating the Performance of a Classification Tree, Navie Bayes Classifier

Regression Trees : Prediction, Measuring Impurity, Evaluating Performance Advantages and Weaknesses of a Tree

Unit 8: Clustering **(04)**

Introduction, Feature selection for clustering: Filter models and Wrapper models, k-Means algorithm

In Semester Evaluation (ISE)

ISE shall be based upon minimum 6 assignments based on curriculum and consisting of literature survey, case study, data compilation and analysis etc.

Reference Books

1. Data Mining for Business Analytics - Concepts, Techniques, And Applications In R, Galit Shmueli Peter C. Bruce Inbal Yahav Nitin R. Patel Kenneth C. Lichtendahl, Jr., Wiley Publication https://edu.kpfu.ru/pluginfile.php/274079/mod_resource/content/2/DatMiningBusAnalytics.pdf
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and PresentingData by EMC Education Services (2015)
3. Business Analytics – Principles, Concepts and Applications, Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey, Pearson Education Limited
4. Data Mining : The Textbook, Charu C. Agrawal, Springer Publications

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING)

Semester-III

2. Open Elective Course- ii. Operations Research

Teaching Scheme
Lectures - 3 Hours/week, 3 Credits

Examination Scheme
ESE- 70 Marks
ISE- 30 Marks

Course Objectives

The course aims to train the students -

1. To formulate the appropriate O.R. model
2. To use quantitative techniques in solving the real life problems
3. To evaluate alternative courses of actions in actual decision making under conditions ofuncertainty.

Course outcomes :

At the end of this course the students shall be able to

1. Formulate the real life managerial problems in an appropriate mathematical model
2. Provide the optimum solution to the real life problems within the constraints.
3. Use network techniques in project management
4. To evaluate alternative courses of actions in actual decision making under conditions of uncertainty using Simulation techniques.

SECTION-I

Unit 1: **(5)**

OR Models, model formulation, Linear Programming models, Graphical solution, Simplex techniques,Two Phase method

Unit 2: **(5)**

Duality theory - Properties of Primal and Dual Optimal Solutions, Duality Simplex method, ShadowPrice- Sensitivity analysis

Unit 3: **(5)**

Simulation Techniques - Need of Simulation techniques , Monto-Carlo Simulation, random numberconcept, applications of Simulation technique

Unit 4: **(3)**

Queuing Models - Introduction, Structure of queuing system, Terminology (Kendal‘s Notations)and Applications. Queuing Model M/M/1: /FIFO,

SECTION II

Unit 5 : **(5)**

Inventory control - Inventory costs, Economic order quantity, deterministic models with or without shortages - probabilistic models - Price break model, Selective Inventory management techniques.

Unit 6: **(5)**

Replacement analysis - Replacement models - Replacement policy for items considering change inmoney value with time - Individual replacement policy - Group replacement policy

Unit 7: **(3)**

Network flow models - Minimal Spanning Tree problems -Shortest route probems - Dijiktra'salgorithm - Maximal Flow problem

Unit 8 : **(5)**

PERT and CPM Networks - floats and applications -
Network crashing - Cost optimization - Resource allocation and scheduling

In Semester Evaluation (ISE)

ISE shall be based upon minimum 5 assignments and at least one case study.

Reference Book

1. Operations Research by Hillier and Lieberman TMGH
2. Hamdy Taha, "Operations Research – An Introduction", 7th edition PHI (2003)
3. S. D. Sharma, "Operation Research", Kedarnath and Rannalt Pub.
4. Hira and Gupta, "Operation Research", S. Chand and Co.
5. N.D. Vohra, "Quantitative Techniques in Management", TMGH
6. Shrinath L.S. : PERT and CPM – Affiliate East West Press
7. Anand Sharma "Quantitative Techniques for decision making", Himalaya Publishing house
8. Billy E. Gillet "Introduction to Operation Research" TMGH
9. R. Panneerselvan "Operations Research", PHI

2. Open Elective Course: iii. Cost Management of Engineering Projects

Teaching Scheme
Lectures - 3 Hours/week, 3 Credits

Examination Scheme
ESE- 70 Marks
ISE- 30 Marks

Course objectives:-

The course aims to train the students to apply scientific principles and techniques to

1. Cost estimating of engineering project
2. Control Cost of the various elements of engineering project
3. Carry out value analysis

Course outcomes:-

At the end of this course the students shall be able to

1. Analyze various elements of the cost associated with the engineering project
2. Measure and assess the performance of engineering projects
3. Control the cost of project
4. carry out value analysis in an engineering project

Unit no.	Details	Contact Hours
	Section-I	
1	**Cost :** Cost Elements - Pricing , Materials ,Labor , Engineering , Equipment, Parts andTools; Economic Costs ; **Cost Analysis:** Diect Cost, indirect Cost, Overhead, allowancwe, Contingency	**8**
2	**Cost Estimating :** Estimating Models; Parametric estimating- moduler estimating, parametric model , Analogous estimating- ratio estimating, The Three-quarters rule, TheSquare root rule, Two-Thirds rule, Range estimating	**7**
3	**Progress & Cost Control :** Progress Measurement and Earned Values; Earned Value for Variable Budgets; Tracking Cost and Schedule Performance;	7
	Section-II	
4	**Cost Management:** Causes of Change, Feed Forward Techniques, Impact of schedule on cost, Lifecycle costs, Impact of project risk, integrated cost management programme	8

5	**Value Management:** Concept of Value ,Dimensions and Measures of Value , Overview of Value Management, Definition' Scope, Key Principles of VM , Key Attributes of VM ,Value Management Terms , Need for Value Management in Projects , The Value Management Approach ,Cross-functional Framework ' Use of Functions, Structured Decision Process, The VM Process, Benefits of Value Management, Other VM requirements Relationship between Project Value and Risk, Value Management as an Aid to Risk Assessment	7
6	**Value Analysis:** Earned Value Management for assessing project performance, Earned Value Management , Earned Value Management Model, Fundamentals of Earned Value, EVM Terminology, Relevancy of Earned Value Management, Conducting an Earned Value Analysis , Performing an Earned Value Assessment, Managing a Portfolio of Projects with Earned Value Management, Important Issues in the Effective Use of Earned Value Management. Integrating Cost and Value in Projects.	7

Reference Book:-

1. Project Estimating and Cost Management By Parivs F. Rad PhD, PMP
2. Project Cost Management guide from PMBOK 5th edition
3. Project Scheduling and Cost Control: Planning, Monitoring and Controlling the Baselineby James Taylor
4. Systems Life Cycle Costing: Economic Analysis, Estimation, and Management, John V. Farr,Draft Textbook, Version 1.0.
5. COST AND VALUE MANAGEMENT IN PROJECTS Ray R. Venkataraman and Jeffrey K.Pinto John Wiley & Sons, Inc Inc., Hoboken, New Jersey
6. American Association of Cost Engineers, "SKILLS AND KNOWLEDGE OF COST ENGINEERING", 1996
7. Cost Management of Capital Projects (Cost Engineering) by Kurt Heinze – International Edition, August 28, 1996

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING)

Semester-III

2. Open Elective Course- iv. Non-Conventional Energy

Teaching Scheme
Lectures - 3 Hours/week, 3 Credits

Examination Scheme
ESE- 70 Marks
ISE- 30 Marks

SECTION-I

Unit 1: Energy Resources **(5 Hrs)**

Energy, economy and social development, Indian scenario, conventional energy sources- electric, nuclear, hydroelectric, environmental aspects, renewable energy sources, comparison between conventional and non-conventional energy sources

Unit 2: Energy Conservation and Efficiency **(5 Hrs)**

Energy efficiency, conservation, energy audit, cogeneration, schemes to promote conservation and efficiency, new technologies, energy conservation opportunities, distributed energy systems

Unit 3: Energy Storage **(3 Hrs)**

Introduction, necessity, specifications of energy storage devices, methods of energy storage

Unit 4: Solar Thermal Energy **(5 Hrs)**

Introduction to solar radiation and energy, solar thermal energy collectors, solar thermal systems- water heater, distillation, power plant, cookers, kilns, air conditioning, greenhouse, furnace, dryer, industrial heating

SECTION-II

Unit 5: Solar Photovoltaic System **(5 Hrs)**

Solar cell fundamentals, characteristics, design consideration, classification, module and arrays, maximizing the output and load matching, balance of system, applications

Unit 6: Wind Energy **(5 Hrs)**

Fundamentals, wind energy estimation, turbines: types, construction and characteristics, modes of power generation, wind energy conversion system, wind –diesel hybrid system, wind energy storage, environmental aspects, applications

Unit 7: Biomass Energy **(4 Hrs)**

Fundamentals, resources, conversion technologies, urban waste to energy conversion, gasification, ethanol, biogas

Unit 8: Emerging Technologies **(4 Hrs)**

Fuel cell, classification, comparisons, fuel for fuel cells, efficiency and VI characteristics, fuel cell power plant, hydrogen as energy carrier

In Semester Evaluation (ISE)

ISE shall be based upon minimum 6 assignments based on curriculum and consisting of literature survey, case study, data compilation and analysis etc.

Reference Books

1. Non-Conventional Energy Resources, B H Khan, McGraw Hill Education, Third Edition
2. Renewable Energy Sauces and Emerging Technologies, D P Kothari, K C Singal, Rakesh Ranjan,PHI Learning Pvt. Ltd., Second Edition

FACULTY OF SCIENCE & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING)
Semester-III

2. Open Elective Course- v. Product Design & Development

Teaching Scheme
Lectures - 3 Hours/week, 3 Credits

Examination Scheme
ESE- 70 Marks
ISE- 30 Marks

Unit no.	Details	Contact Hours
	Section-I	
1	**Introduction to product design and development** Product life cycle Product policy of an organization and profitable product selection Product design Product design steps and analysis	**5**
2	**Value Engineering and analysis** Value Engineering concepts Problem Identification Functional analysis Functional analysis system steps Case study on Value Engineering and analysis	**5**
3	**Quality Function Deployment** Computer Aided Design Robust Design Design for X Ergonomics in product design	3
	Section-II	
4	**Ergonomics in product design** Ergonomics/ Human factors, Posture and movement, Ergonomic design process, Performance support and design intervention, Design Ergonomics in India: scope for exploration	**7**
5	**DFMA:Design for Manufacturing and Assembly** DFMA guidelines Product Design for manual assembly Design guidelines for different processes Rapid prototyping – concepts and advantages Prototyping processes	5

6	**Economic Decision-**Making/Cost Evaluation, Life cycle analysis Planning and Scheduling, Planning for manufacturing Project planning, Risk and Opportunity Management, Metrics for Design and Development, Program Leadership, Management, and Control, Project start-up, Plans/schedules Design for Cost: Design for Six Sigma: process, Invent, Innovate, Develop, Optimize and Verify.	5

Text Books:

1. Ulrich, Karl, and Steven Eppinger. Product Design and Development. McGraw-Hill,
2. Kemnneth Crow: Concurrent Engg./Integrated Product Development, DRM
3. Staurt Pugh: Tool Design -Integrated Methods for Successful Product Engineering, Addison Wesley Publishing, New York, NY.

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING)

Semester-III

Dissertation Phase – I : Synopsis Submission Seminar

Teaching Scheme	**Examination Scheme**
Practical: 4 Hrs/Week	**Credits:3**
	ISE: 100 marks

Phase I Synopsis Submission Seminar (ISE): A student shall be expected to carry out intensive literature survey for a period of about two months in the field of interest and to select a topic for his/her dissertation in consultation with the faculty adviser assigned. The student shall then submit a report and deliver a seminar on the problem chosen by him/her to the panel of three departmental PG recognized faculty members. It shall be expected that a student justifies the gravity and also the relevance of the problem through his/her seminar. This shall be for the approval of synopsis.

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING)

Semester-III

1.Dissertation Phase – II : ICA

Examination Scheme
Credits:3
ICA : 100 marks

Phase II Term Work (ICA)

Phase II evaluation consists of term-work evaluation (ICA) based on the efforts put in by the studentto carry out his/her work & the results obtained thereof.

2.Dissertation Phase – II : Progress Seminar

Examination Scheme
Credits:3
ESE : 100 marks

Phase II Progress Seminar Presentation (ESE):

The End Semester Evaluation (ESE) consisting of submission of progress report and presentation of progress seminar followed by demonstration before a panel three departmental PG recognized faculty members.

Guidelines for Assessment of Dissertation Phase I & II

1. Quality of Literature survey and Novelty in the problem
2. Clarity of Problem definition and Feasibility of problem solution
3. Clarity of objective and scope

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING)

Semester – IV

Dissertation Phase – III : Progress Seminar

Teaching Scheme	**Examination Scheme**
Practical: 4 Hrs/Week	**Credits: 3**
	ISE: 100 marks

Phase III Term Work and Progress Seminar Presentation and report (ISE):

The student who has cleared his/her Phase II evaluation shall submit a report and present the status of work carried out on the dissertation, after 8-10 weeks of Phase II ESE, to three departmental PG recognized faculty members.

Guidelines for Assessment of Dissertation Phase III

1. Quality of work attempted
2. Presentation skills
3. Relevance to the specialization

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING)

Semester – IV

Dissertation Phase – IV : Termwork

Teaching Scheme
Practical: 2 Hrs/Week

Examination Scheme
Credits: 6
ICA: 200 marks

After completing the dissertation work to the satisfaction, the student shall submit the dissertation report in the prescribed format to the university.

Guidelines for Assessment of Dissertation Phase IV Termwork

1. Fulfilment of objectives
2. Validation of results
3. Quality of Written Presentation

- **Students should publish at least one paper based on his/her work in reputed InternationalJournal (desirably in Referred Journal)**

P A H SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

M.Tech. (COMPUTER SCIENCE & ENGINEERING)

Semester – IV

Final Presentation and Viva-voce

Examination Scheme
Credits: 6
ESE: 200 marks

Final Presentation and Viva-voce (ESE):

Open defense of the student on his/her dissertation shall be arranged by the university. This defense shall be in front of the panel of examiners as appointed by university authority.