SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF ENGINEERING & TECHNOLOGY

COMPUTER SCIENCE AND ENGINEERING

CBCS Syllabus for

First Year M.Tech.
w.e.f. Academic Year 2023-24

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & TECHNOLOGY
STRUCTURE OF M.Tech. (COMPUTER SCIENCE & ENGINEE ING)
Four Semester Course
Choice Based Credit System Syllabus wef 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* 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)

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & TECHNOLOGY
STRUCTURE OF M.Tech. (COMPUTER SCIENCE & ENGINEERING)
Four Semester Course
Choice Based Credit System Syllabus wef 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	--	--	--	
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	Soft Computing	Advanced Cloud Computing	Infrastructure Management
3	Computer Vision	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.

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STRUCTURE OF M.Tech. (COMPUTER SCIENCE & ENGINEE ING)
Four Semester Course
Choice Based Credit System Syllabus
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

List Self Learning Courses

Sr. No.	***Self Learning Subject***
1	Big Data
2	Computer Network Administration
3	Open Source Technologies
4	Usability Engineering

List of open Elective Courses

Sr. No.	***Self Learning Subject***
1	Business Analytics
2	Operation Research
3	Cost Management of Engineering Projects
4	Non conventional Energy

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

SOLAPUR UNIVERSITY, SOLAPUR
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STRUCTURE OF M.Tech. (COMPUTER SCIENCE & ENGINEE ING)
Four Semester Course
Choice Based Credit System Syllabus
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.

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

Teaching Scheme	Examination Scheme
Lectures – 3 Hours/week, 3 Credits	ESE – 70 Marks
Practical – 2 Hour/week, 1 Credit	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 S hortest 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

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SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & 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 ENGINEERING & 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 f r 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 **(3)**
KDD environment

SECTION-II

Unit 6 : Visualization **(4)**
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

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SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER I
4. MACHINE LEARNING

Teaching Scheme
Examination Scheme **ESE – 70 Marks**
Lectures– 3 Hours/week, 3 Credits **ISE – 30 Marks**
Practical – 2 Hour/week, 1 Credit **ICA – 25 Marks**

SECTION-I

Unit 1 Introduction **(6)**

Machine learning: what and why?, Supervised learning, Unsupervised learnin , 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 estimation (least squares), Robust linear regression, Ridge regression, Bayesian linear regression
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, elevance Vector 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

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

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 **(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 Algorit ms, Noun Structure, Non-noun Structure and Parsing Algorithms, Robust and Scalable Parsing on Noisy Text as in Web documents Probabilistic parsing, Hybrid of Rul Based and Probabilistic Parsing sequence labeling, Training issues , Arguments and Adjuncts , inside- utside probabilities , Scope Ambiguity a d Attachment Ambiguity resolution.

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.

SECTION-II

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.

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FACULTY OF ENGINEERING & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER I
ELECTIVE-I: 3. COMPUTER VISION

Teaching Scheme
Lectures:3 Hrs/week
Tutorials: 1 Hrs/week

Examination Scheme
ESE: 70 Marks
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, histogra , color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing

Unit 5 **(9)**

Pattern Analysis: Clustering: K-Mea s, 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 Recognitio , 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, B⌣ngio, and Courville.
3. Dictionary of Computer Vision and Image Processing, by Fisher et al.

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FACULTY OF ENGINEERING & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER I
ELECTIVE-I: 3. SOFT COMPUTING

Teaching Scheme
Lectures:3 Hrs/week
Tutorials: 1 Hrs/week

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

SECTION-I

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

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

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.

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER I
ELECTIVE-I: 4. OBJECT ORIENTED SOFTWARE ENGINEERING

Teaching Scheme
Lectures:3 Hrs/week
Tutorials: 1 Hrs/week

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

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 iew: 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

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & 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 - 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 an simulation: (7)
Mathematical modeling – need, tech iques and classification, system models –types, static, dynamic, system simulation – why to simulate, techni ue of simulation, Monte Carlo simulation, types, continuous modeling, discrete model, Role of probability a d 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*)

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & 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/ luetooth 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 Datab se, 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

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & 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 V ctor 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 Messag s, 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, llocation 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)

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & TECHNOLOGY
M.Tech. (COMPUTER SCIENCE & ENGINEERING) Part I
SEMESTER II
Elective – II 1. Reinforcement 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 **(5)**
Reinforcement Learning, Examples, Elements of Reinforcement Learning, An E tended Example: Tic-Tac-Toe, History of Reinforcement Learning

Unit 2 Evaluative Feedback **(5)**
A k-armed Bandit Problem, Action-value Methods,The 10-armed Testbed,Incremental Implementation

Unit 3 The Reinforcement Learning Problem **(6)**
The Agent–Environment Interface, Goals and Rewards , Returns , Unified Notation for Episodic and Continuing Tasks, Value Functions,Optimal Value Functions, Optimality and Approximation

Unit 4 Finite Markov Decision Processes **(6)**
The Agent–Environment Interface, Goals and Rewards, Returns and Episo es, Unified Notation for Episodic and Continuing Tasks, Poli ies and Value Functions.

SECTION II

Unit 5 Dynamic Programming **(5)**
Policy Evaluation (Prediction),Policy Improvement, Policy Iteration, Value Iteration ,Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming, Introduction to Monte Carlo Methods

Unit 6 Temporal-Difference Learning **(5)**
TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-policy TD Control,Q-learning: Off-policy TD Control , Games, Afterstates, and Other Special Cases

Unit 7 Planning and Learning **(6)**
Models and Planning , Dyna: Integrating Planning, Acting, and Learning , When the Model Is Wrong , Prioritized Sweeping, Expected vs. Sample Updates, Trajectory Sampling , Real-time Dynamic Programming , Planning at Decision Time, Heuristic Search, Rollout Algorithms.

Unit 8 Applications and Case Studies **(6)**
TD-Gammon, Samuel's Checkers Player, Watson's Daily-Double Wagering, Optimizing Memory Control, Human-level Video Game Play, Mastering the Game of Go, AlphaGo, AlphaGo Zero, Personalized Web Services, Thermal Soaring.

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

Text Books:

1. Reinforcement Learning: An Introduction (Second edition + Upcoming Edition) by: Richard S. Sutton and Andrew G. Barto, MIT Press Publication
(The book is available at http://incompleteideas.net/book/the-book-2nd.html Upcoming edition's January 1 2018 draft available at http://incompleteideas.net/book/bookdraft2018jan1.pdf]

Reference Books:

1. Reinforcement Learning: With Open AI, TensorFlow and Keras Using Python By Abhishek Nandy, Manisha Biswas. Apress Publication
2. Reinforcement Learning: State-of-the-Art, Marco Wiering and Martijn van Otterlo, Eds.
3. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig.
4. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville.

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & 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

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & 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 P ocessing (7)

Levels of Parallelism (instruction, transaction, task, thread, memory, and functio), 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 Environme ts: Software tools and environments,Y-MP,Paragon and CM-5 Environment, Visualization and erformance 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.

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & 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 Ac ess Control Violations); Opportunities and hallenges;

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 Optimiz tion);

SECTION-II

Unit 4 : Network Virtualisation (7)
Abstraction of Physical Network (c nstrained forwarding model, distributed state, detailed configuration); components of a virtual network (Virtual Switch, Bridge, Host-virtual adapter, AT 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

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & 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 w 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 S nsor Applications, Habitat Monitoring, Category 2 WSN Applications: Home Control, Building Automation, Industrial Automation, Medical Applications

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

Introduction, Sensor Node Technology, Hardware and Software, Sensor Taxonomy, WN Operating Environment, WN Trends, Introd ction 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 esign **(4)**

Hardware Constraints, Fault Tolera ce, 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

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & 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 rotection, 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.

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & 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 Scheduli g, 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- ime 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, A plications 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 a d 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

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FACULTY OF ENGINEERING & 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 ueries 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 ransactions, Transaction Management in ulti-databases, Distributed Transaction Management, Main Me ory Databases, and Advanced Transaction odels.

SECTION II

Unit 4 **(8)**

Semi-Structured Data and XML Se i-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, SO P, WSDL, UDDI, XML database Application.

Unit 5 **(6)**

Emerging Trends in Databases: Tem oral 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

Reference Books:

1. Web Data Management, Abiteboul, Loana, Philippe Et. al Cambridge publication
2. Database Systems, Thomas Connolly, Carolyn Begg, Pearson 4th Edition
3. Database Management Systems by Raghu Ramakrishnan and Johannes Gehrke