

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**CS2101: Mathematical Foundations of Computer Science**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total Credits</b>	<b>3</b>	<b>ESE</b>	60

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Interpret the basic notions of discrete and continuous probability.
- 2 Analyze the methods of statistical inference.
- 3 Perform correct and meaningful statistical analyses of simple to moderate complexity.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Random Variables:</b> Discrete random variables: Random variables and their event spaces, Analysis of program MAX, Discrete random vectors, Independent random variables Continuous random variables: The exponential distribution, Reliability and failure rate, Functions of a random variables, Order statistics, Distribution of sums	(07)
<b>Unit 2</b>	<b>Probability:</b> Probability mass, Density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities.	(07)
<b>Unit 3</b>	<b>Markov Chains:</b> Discrete-Time Markov Chains: Introduction, Computation of n-step transition probabilities, State classification and limiting probabilities, Distribution of time between state changes, Markov modulated Bernoulli process, Irreducible finite chains with aperiodic states, The M/G/1 queuing system, Discrete time birth-death processes Continuous-Time Markov Chains: The birth- death process, Non-birth-death process, Markov chains with absorbing states.	(11)
<b>Unit 4</b>	<b>Stochastic Processes:</b> Introduction, Classification of stochastic processes, The Bernoulli process, The poison process, Renewal process, Availability analysis, Random analysis.	(08)
<b>Unit 5</b>	<b>Regression and Analysis of Variance:</b> Introduction, Least-squares curve fitting, The coefficients of determination, Confidence intervals in linear regression, Trend detection and slope estimation, Correlation analysis, Analysis of variance.	(10)
<b>Unit 6</b>	<b>Statistical Inference:</b> Introduction, Parameter estimation, Hypothesis testing.	
<b>Text Books:</b>		(05)

- 1 John Vince, "Foundation Mathematics for Computer Science", Springer Cham, 2015.
- 2 K. Trivedi, "Probability and Statistics with Reliability, Queuing, and Computer Science Applications", Wiley Publication.

**References:**

- 1 M. Mitzenmacher, E. Upfal, "Probability and Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press; 2<sup>nd</sup> edition, 2017.
- 2 Alan Tucker, "Applied Combinatorics", Wiley, Wiley; 6<sup>th</sup> edition, 2016.
- 3 T.Veerarajan, "Probability, Statistics and Random Process", Tata Mc-Graw Hill Co., 3<sup>rd</sup> Edition, 2016.
- 4 Norman L.Biggs, "Discrete Mathematics", 2<sup>nd</sup> edition, Oxford University Press, 2017.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/111106102/> Prof. Soumen Maity, IISER, Pune.
- 2 <https://nptel.ac.in/courses/122104017/> Prof. S. K. Ray, IIT, Kanpur.

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	-	1	-
CO2	-	1	2	-	-	-	-	-	-	-	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	-	5
Apply	5	5	15
Analyze	5	5	20
Evaluate	5	5	10
Create	-	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**CS2102: Advanced Data Structures and Algorithms**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Develop algorithms for text processing applications.
- 2 Identify suitable data structures and develop algorithms for computational geometry problems
- 3 Determine the appropriate data structure for solving a particular set of problems
- 4 Categorize the different problems in various classes according to their complexity.

**Course Contents**

	<b>Hours</b>
<b>Unit 1 Skip Lists:</b> Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists,	(05)
<b>Unit 2 Text Processing:</b> Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.	(10)
<b>Unit 3 Computational Geometry:</b> One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees.	(08)
<b>Unit 4 Matroids:</b> Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.	(08)
<b>Unit 5 Flow-Networks:</b> Max flow-min cut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.	(08)
<b>Unit 6 Linear Programming:</b> Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness, Approximation algorithms, Randomized Algorithms	(08)

**Text Books:**

- 1 Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, 2<sup>nd</sup> Edition, Pearson, 2004.
- 2 M T Goodrich, Roberto Tamassia, “Algorithm Design”, John Wiley, 2002.
- 3 Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", MIT Press Ltd, 3<sup>rd</sup> edition.
- 4 Aho, Hopcroft, Ullman, "The Design and Analysis of Computer Algorithms", Pearson education, 2009.

**References:**

- 1 Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, “Data Structures Using C and C++”, Pearson Publication, 2006.
- 2 E. Horowitz, S. Sahani, S.Anderson Freed, “Fundamentals of Data Structures in C”, SP Publication, 2<sup>nd</sup> Edition.
- 3 Thomas H. Cormen, Leiserson .C.E, Rivest.R.L, Stein.C, “Introduction to Algorithm”, 2<sup>nd</sup> edition (2001), MIT press, USA.
- 4 Kleinberg, Tardos,"Algorithm Design", Pearson education.
- 5 S. Sridhar, “Design and Analysis of Algorithms”, Oxford, 2014.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106103069/> IIT Guwahati.
- 2 <https://nptel.ac.in/courses/106104019/> IIT, Kanpur
- 3 <https://nptel.ac.in/courses/106101060/> IIT, Bombay

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	2	-	1	-	-	-	-	-	-	1	-
CO2	-	1	3	1	-	-	-	-	-	-	1	-
CO3	-	-	2	3	-	-	-	-	-	-	1	1
CO4	-	3	-	1	-	-	-	-	-	-	1	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	20
Analyze	5	5	10
Evaluate	5	5	20
Create	5	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**CS2105: Research Methodology**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	2 Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	2	<b>ESE</b>	60
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Discover research problem formulation.
- 2 Analyze research related information.
- 3 Evaluate the research ethics.
- 4 Appraise that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- 5 Illustrate the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- 6 Formulate IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

**Course Contents**

	<b>Hours</b>
<b>Unit 1</b> <b>Meaning of research problem:</b> Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations	(06)
<b>Unit 2</b> <b>Effective literature studies approaches:</b> analysis, Plagiarism, Research ethics	(03)
<b>Unit 3</b> <b>Effective technical writing:</b> how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee	(04)
<b>Unit 4</b> <b>Nature of Intellectual Property:</b> 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	(06)
<b>Unit 5</b> <b>Patent Rights:</b> Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	(04)
<b>Unit 6</b> <b>New Developments in IPR:</b> Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs	(03)

**Text Books:**

- 1 C. R. Kothari, “Research methodology”, New Age International Publisher, 2<sup>nd</sup> Edition.
- 2 Stuart Melville, Wayne Goddard, “Research methodology: An introduction for science & engineering students”, Juta Academic; 2<sup>nd</sup> edition, 2001
- 3 Wayne Goddard, Stuart Melville, “Research Methodology: An Introduction”, Juta Academic; 2<sup>nd</sup> edition, 2001

**References:**

- 1 Ranjit Kumar, “Research Methodology: A Step by Step Guide for beginners”, 2<sup>nd</sup> Edition.
- 2 Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.
- 3 Mayall, “Industrial Design”, McGraw Hill, 1992.
- 4 Niebel, “Product Design”, McGraw Hill, 1974.
- 5 Asimov, “Introduction to Design”, Prentice Hall, 1962.
- 6 Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
- 7 T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008.
- 8 Prabuddha Ganguli, “Intellectual Property Rights: Unleashing the Knowledge Economy”, Tata McGraw-Hill Publishing Company, ISBN: 0074638602, 9780074638606, 2001.
- 9 Kalyan C. Kankanala, “Indian Patent Law”, Oxford University Press, ISBN: 9780198089605, 0198089600, 2012.
- 10 Kalyan C. Kankanala, “Fundamentals of Intellectual Property”, Asia Law House, ISBN: 9789381849514, 938184951X, 1<sup>st</sup> Edition, 2012.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/121106007/> IIT Madras
- 2 <https://nptel.ac.in/courses/107108011/> IISc Bangalore

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	1	-	-	-	3	-	2	-	-	3
CO2	-	-	3	-	2	-	3	-	-	-	-	3
CO3	-	-	3	-	1	-	-	-	2	-	-	3
CO4	-	-	2	-	3	-	-	-	1	-	-	3
CO5	-	-	3	-	-	-	2	-	-	-	3	-
CO6	-	-	1	-	3	-	-	-	-	-	3	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	5	5
Apply	5	5	10
Analyze	5	5	20
Evaluate	5	5	10
Create	5	-	15
Total	20	20	60





**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**CS2107: Laboratory 2 (Based on Elective I & II)**

<b>Laboratory Scheme</b>		<b>Examination Scheme</b>	
<b>Practical</b>	4 Hrs/week	<b>ISE</b>	<b>50</b>
<b>Total</b>	<b>2</b>	<b>ESE</b>	<b>--</b>
<b>Credits</b>			

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Implement various artificial neural network algorithms.
- 2 Illustrate the basics of network protocol and simulation tools.
- 3 Interpret the concepts of fuzzy logic.
- 4 Demonstrate various data analysis and visualization tools.
- 5 Implement RPC, RMI and EJB in distributed systems.
- 6 Implement protocols of Wireless and Mobile Networks

**Course Contents**

**Group A - Machine Learning**

- Experiment 1** Write a program to demonstrate the working of the decision tree based ID3 Algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
- Experiment 2** Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
- Experiment 3** Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
- Experiment 4** Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
- Experiment 5** Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
- Experiment 6** Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

**Group B - Wireless Sensor Networks**

- Experiment 7** Study about NS2 or any other simulator in detail.
- Experiment 8** Create scenario and study the performance of token bus protocol through simulation.
- Experiment 9** Create scenario and study the performance of token ring protocols through simulation.
- Experiment 10** Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
- Experiment 11** Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination
- Experiment 12** Implement and study the performance of CDMA on NS2/NS3/ any other simulators (Using stack called Call net) or equivalent environment.

### **Group C - Introduction to Intelligent Systems**

- Experiment 13** Develop an artificial neural network using Python.  
**Experiment 14** Write a program for Fuzzy Logic using Python.  
**Experiment 15** Write a Python program to solve 8 queens problem  
**Experiment 16** Write a Python program to solve any problem using depth first search.  
**Experiment 17** Write a Python program to solve any problem using best first search.  
**Experiment 18** Write a Python program to solve traveling salesman problem.

### **Group D - Data Science**

- Experiment 19** Create a calculator application using R.  
**Experiment 20** Reading and writing different types of datasets  
a. Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location.  
b. Reading Excel data sheet in R.  
c. Reading XML dataset in R.  
**Experiment 21** Visualizations using R  
a. Find the data distributions using box and scatter plot.  
b. Find the outliers using plot.  
c. Plot the histogram, bar chart and pie chart on sample data  
**Experiment 22** Data processing  
Create an application for data processing using Python, Pandas and Numpy.  
**Experiment 23** Data Visualization  
Create an application for data visualization using Python, Pandas and Numpy.  
**Experiment 24** Create an application for analysing data using Python.

### **Group E - Distributed Systems**

- Experiment 25** Implementation of multi-threaded client/server processes.  
**Experiment 26** Write a program to demonstrate process/code migration.  
**Experiment 27** Implementation of a distributed application using EJB  
**Experiment 28** Create CORBA based server-client application  
**Experiment 29** Implementation of an Election algorithm.  
**Experiment 30** Implementation of Banker's Algorithm for avoiding Deadlock

### **Group F – Internet of Things**

- Experiment 31** Experiment based on IR sensor. Write an application to detect obstacle and notify user using LED  
**Experiment 32** Experiment based on FIRE sensor. Write an application to detect Fire and notify users using LED.  
**Experiment 33** Create a simple web interface using IoT kit to control the connected LEDs remotely through the interface  
**Experiment 34** Study and implement clustering and configuring devices using MPI library  
**Experiment 35** Study of different types of sensors, actuators.  
**Experiment 36** Experiment based on IoT kit to control the operation of elevator operations

#### **List of Submission:**

1. Total number of Experiments :  
**Solve any two group experiments of respective elective subjects.**



**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**CS2113: Program Elective-I: Machine Learning**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Illustrate features that can be used for a particular machine learning approach in various IOT applications.
- 2 Compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
- 3 Analyze various machine learning approaches and paradigms.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Supervised Learning (Regression/Classification):</b> Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression, Generalized, Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	(10)
<b>Unit 2</b>	<b>Unsupervised Learning:</b> Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models)	(06)
<b>Unit 3</b>	<b>Evaluating Machine:</b> Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random forests)	(07)
<b>Unit 4</b>	<b>Sparse Modelling and Estimation:</b> Modelling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning	(09)
<b>Unit 5</b>	<b>Scalable Machine Learning (Online and Distributed Learning):</b> A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference	(09)
<b>Unit 6</b>	<b>Recent trends</b> in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications	(05)

**Text Books:**

- 1 Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
- 2 Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer 2009 (freely available online).

3 Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.

**References:**

- 1 Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 2<sup>nd</sup> Edition.
- 2 Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly, 2006.
- 3 Tom M. Mitchell. "Machine Learning" McGraw-Hill, 1997.
- 4 P. Langley. "Elements of Machine Learning" Morgan Kaufmann Publishers, Inc. 1996.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106105152/> IIT Kharagpur
- 2 <https://nptel.ac.in/courses/106106139/> IIT Madras

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	3	1	-	-	-	-	-	-	2	1
CO2	-	1	-	3	-	-	-	-	-	-	1	2
CO3	-	1	2	-	-	-	-	-	-	-	3	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	10
Analyze	5	5	15
Evaluate	5	5	20
Create	5	5	15
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**CS2123: Program Elective-I: Wireless Sensor Networks**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	60
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Describe and explain radio standards and communication protocols for wireless sensor networks.
- 2 Appraise the function of the node architecture and use of sensors for various applications.
- 3 Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.

**Course Contents**

	<b>Hours</b>
<b>Unit 1 Introduction to Wireless Sensor Networks:</b> Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture Hardware Platforms: Motes, Hardware parameters	(09)
<b>Unit 2 Introduction to NS-3:</b> Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example	(09)
<b>Unit 3 Medium Access Control Protocol design:</b> Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled Introduction to Markov Chain: Discrete time Markov Chain definition, properties, classification and analysis MAC Protocol Analysis: Asynchronous duty-cycled. X-MAC Analysis (Markov Chain)	(09)
<b>Unit 4 Security:</b> Possible attacks, countermeasures, SPINS, Static and dynamic key distribution	(08)
<b>Unit 5 Routing protocols:</b> Introduction, MANET protocols Routing protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast Opportunistic Routing Analysis: Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks.	(10)
<b>Unit 6 Advanced Topics:</b> Recent development in WSN standards, software applications	(04)

**Text Books:**

- 1 W. Dargie, C. Poellabauer, "Fundamentals of Wireless Sensor Networks –Theory and Practice", Wiley 2010.
- 2 Kazem Sohraby, Daniel Minoli, TaiebZnati, "Wireless sensor networks -Technology, Protocols,

and Applications”, Wiley Inter science 2007.

- 3 Takahiro Hara, Vladimir I. Zadorozhny, Erik Buchmann, “Wireless Sensor Network Technologies for the Information Explosion Era”, Springer 2010.

**References:**

- 1 Holger Kerl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Network”, John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)
- 2 Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, “Wireless Sensor Network”, Springer 1<sup>st</sup> edition, 2004.
- 3 Kazem, Sohraby, Daniel Minoli, Taieb Zanti, “Wireless Sensor Network: Technology, Protocols and Application”, John Wiley and Sons 1<sup>st</sup> edition 2007
- 4 Savo G. Glisic, “Advanced Wireless Networks: Technology and Business Models”, Wiley Publication, 3<sup>rd</sup> edition.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106105160> IIT, Kharagpur

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	1	2	-	-	-	-	-	-	1	1
CO2	-	2	2	3	-	-	-	-	-	-	2	2
CO3	-	1	2	1	-	-	-	-	-	-	2	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	-	-
Apply	5	5	10
Analyze	5	5	20
Evaluate	5	5	20
Create	-	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**CS2133: Program Elective-I: Introduction to Intelligent Systems**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3 Hrs/week	<b>ISE</b>	20
<b>Tutorial</b>	--	<b>MSE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Demonstrate knowledge of the fundamental principles of intelligent systems.
- 2 Analyse and compare the relative merits of a variety of AI problem solving techniques

**Course Contents**

	<b>Hours</b>
<b>Unit 1</b> <b>Biological foundations to intelligent systems I:</b> Artificial neural networks, Backpropagation networks, Radial basis function networks, and recurrent networks	(09)
<b>Unit 2</b> <b>Biological foundations to intelligent systems II:</b> Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.	(06)
<b>Unit 3</b> <b>Search Methods:</b> Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill climbing search. Optimization and search such as stochastic annealing and genetic algorithm.	(07)
<b>Unit 4</b> <b>Knowledge representation and logical inference:</b> Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.	(07)
<b>Unit 5</b> <b>Reasoning under uncertainty and Learning Techniques</b> on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning	(05)
<b>Unit 6</b> <b>Recent trends</b> in Fuzzy logic, Knowledge Representation	(05)

**Text Books:**

- 1 Luger G.F., Stubblefield W.A., “Artificial Intelligence: Structures and strategies for Complex Problem Solving”, Addison Wesley, 6<sup>th</sup> edition, 2008.
- 2 Russell S., Norvig P., “Artificial Intelligence: A Modern Approach”, Prentice-Hall, 3<sup>rd</sup> edition, 2009.
- 3 Martin T. Hagan, Howard B. Demuth, and Mark Beale, “Neural Network Design”, PWS Publishing Company, Boston, 1996



**References:**

- 1 Grosan, Crina, Abraham, Ajith, “Intelligent Systems: A Modern Approach”, Springer.
- 2 Geoff Hulten, “Building Intelligent Systems: A Guide to Machine Learning Engineering”, Apress.
- 3 Luger G.F., Stubblefield W.A, “Artificial Intelligence: Structures and strategies for Complex Problem Solving” Addison Wesley, 6<sup>th</sup> edition.
- 4 Timothy S.Ross, “Fuzzy Logic with engineering applications”, Wiley India Pvt. Ltd., 2011

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106105077/> IIT, Kharagpur
- 2 <https://nptel.ac.in/courses/108104049/> IIT, Kanpur

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	1	1	1	1	-	-	-	-	1	-	2	1
CO2	-	1	1	2	-	-	-	-	-	1	2	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	15
Analyze	5	5	20
Evaluate	5	5	15
Create	5	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**CS2114: Program Elective-II: Data Science**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Relate how data is collected, managed and stored for data science.
- 2 Appraise the key concepts in data science, including their real-world applications and the toolkit used by data scientists.
- 3 Implement data collection and management scripts using MongoDB.

**Course Contents**

	<b>Hours</b>
<b>Unit 1</b> <b>Introduction to core concepts and technologies:</b> Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications	(06)
<b>Unit 2</b> <b>Data collection and management:</b> Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data Sources	(07)
<b>Unit 3</b> <b>Data analysis:</b> Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.	(10)
<b>Unit 4</b> <b>Data visualisation:</b> Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual Encodings	(11)
<b>Unit 5</b> <b>Applications of Data Science,</b> Technologies for visualization, Bokeh (Python)	(07)
<b>Unit 6</b> <b>Recent trends</b> in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science	(07)

**Text Books:**

- 1 Cathy O'Neil, Rachel Schutt, "Doing Data Science: Straight Talk From The Frontline", O'Reilly.
- 2 Jure Leskovek, Anand Rajaraman, Jeffrey Ullman, "Mining of Massive Datasets", Cambridge University Press, v2.1.

**References:**

- 1 Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly.
- 2 Lillian Pierson, "Data Science For Dummies", John Wiley & Sons, 2<sup>nd</sup> edition.
- 3 V.K. Jain, "Data Science & Analytics", Khanna Book Publishing, New Delhi

4 Dinesh Kumar, “Business Analytics”, Wiley India

**Useful Links:**

1 <https://nptel.ac.in/courses/106106179/> IIT, Madras

2 <https://nptel.ac.in/courses/110106064/> IIT, Madras

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	1	1	-	-	-	-	1	1	2	1
CO2	-	-	2	1	-	-	-	-	1	1	1	2
CO3	-	1	2	2	-	-	-	-	-	1	2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	-	-
Apply	-	5	10
Analyze	5	5	20
Evaluate	5	5	20
Create	5	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**CS2124: Program Elective-II: Advanced Distributed Systems**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Design trends in distributed systems.
- 2 Evaluate the concepts of network virtualization.
- 3 Compile remote method invocation and objects

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<p><b>Introduction:</b>            Distributed data processing, Definition DDBS, Advantages and disadvantages of DDBS, Problem areas, Overview of database and computer network concepts.            Distributed database management system architecture: Transparencies in a distributed DBMS, Distributed DBMS architecture, Global directory issues.</p>	(08)
<b>Unit 2</b>	<p><b>Distributed database design:</b>            Alternative design strategies, Distributed design issues, Fragmentation, Data allocation Semantics data control: View management; Data security, Semantic Integrity Control Query processing issues: Objectives of query processing; Characterization of query processors, Layers of query processing, Query decomposition, Localization of distributed data.</p>	(11)
<b>Unit 3</b>	<p><b>Distributed query optimization:</b>            Factors governing query optimization, Centralized query optimization, Ordering of fragment queries, Distributed query optimization algorithms            Transaction management: The transaction concept, Goals of transaction management; Characteristics of transactions, Taxonomy of transaction models            Concurrency control: Concurrency control in centralized database systems, Concurrency control in DDBSs, Distributed concurrency control algorithms, Deadlock management</p>	(11)
<b>Unit 4</b>	<p><b>Reliability:</b>            Reliability issues in DDBSs, Types of failures, Reliability techniques, Commit protocols, Recovery protocols</p>	(08)
<b>Unit 5</b>	<p><b>Parallel database systems:</b>            Parallel architectures, parallel query processing and optimization, load balancing</p>	(06)
<b>Unit 6</b>	<p><b>Advanced topics:</b>            Mobile Databases, Distributed Object Management, Multi-databases</p>	(04)

**Text Books:**

- 1 M.T. Ozsú, P. Valduriez, “Principles of Distributed Database Systems”, Prentice-Hall, 1991.
- 2 D. Bell, J. Grimson, “Distributed Database Systems”, Addison-Wesley, 1992.

**References:**

- 1 Andrew S. Tanenbaum, “Distributed Systems: Principles and Paradigms”, Pearson Prentice Hall, 2<sup>nd</sup> edition, 2007.
- 2 George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems: Concepts and Design”, Pearson Publication, 4<sup>th</sup> edition.
- 3 Pradeep K. Sinha “Distributed Operating Systems”, Prentice Hall of India Private Limited
- 4 Thomas Erl, "Service Oriented Architecture : Concepts, Technology and Design" Prentice Hall
- 5 G. Coulouris, J. Dollimore, T. Kindberg, “Distributed Systems: Concepts and Design",Addison Wesley; 4<sup>th</sup> edition

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106106168/> IIT, Patna
- 2 <https://nptel.ac.in/courses/106106107/> IIT, Madras

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	1	3	-	-	-	-	-	-	1	1
CO2	1	2	-	2	-	-	-	-	-	-	1	1
CO3	-	1	2		-	-	-	-	-	-	2	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	-	-
Apply	5	5	20
Analyze	-	5	15
Evaluate	5	5	15
Create	5	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**CS2134: Program Elective-II: Internet of Things**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Describe requirements from emerging Smart applications, communication systems, protocols and middleware.
- 2 Compare and analyze communication and network protocols used in IoT
- 3 Assess and evaluate mechanisms and algorithms for time synchronization, security and localization in WSNs and IoT.
- 4 Impart knowledge of hardware, operating systems, distributed systems, networking, security and databases required for IoT technology

<b>Course Contents</b>		<b>Hours</b>
<b>Unit 1 Introduction and Applications:</b>	Smart transportation, smart cities, smart Living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software, Interoperability, Big Data and Big Data Mining, Privacy and Security.	(08)
<b>Unit 2 IoT Reference Architecture:</b>	Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints hardware, Data representation and visualization, Interaction and remote control.	(07)
<b>Unit 3 Industrial Automation:</b>	Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things. Commercial Building Automation- Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.	(07)
<b>Unit 4 Hardware Platform for IoT:</b>	Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases.	(08)
<b>Unit 5 IOT Physical Devices &amp; Endpoints:</b>	What is an IOT Device, Exemplary Device Board, Linux on Raspberry, Interface and Programming & IOT Device.	(07)

## Unit 6 Recent trends in IoT with case studies:

Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT. (05)

### Text Books:

- 1 Mandler B., Barja J., Campista Mitre, M.E., Cagá\_ová, D. Chaouchi, H. Zeadally, S. Badra, M. Giordano, S. Fazio, M. Somov, A. Vieriu, R.-L., “Internet of Things. IoT Infrastructures”, Springer International Publishing, Second International Summit, IoT 360° 2015, Rome, Italy, October 27-29, 2015. Revised Selected Papers, Part I.
- 2 Kyung, C.-M., Yasuura, H. Liu, Y. Lin, Y.-L., “Smart Sensors and Systems”, Springer. International Publishing, 2017.

### References:

1. Hersent Olivier, Boswarthick David , Elloumi Omar , “The Internet of Things: Key Applications and Protocols”, Wiley-Blackwell, Second Edition , 2012

### Useful Links:

- 1 [https://onlinecourses.nptel.ac.in/noc22\\_cs53/preview](https://onlinecourses.nptel.ac.in/noc22_cs53/preview) Mr. Sudip Misra IIT, Kharagpur

### Mapping of COs and POs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	-	3	-	-	-	-	-	-	2	1
CO2	-	-	1	1	-	-	-	-	-	-	2	1
CO3	-	1	3	2	-	-	-	-	-	-	2	1
CO4	-	-	2	3	-	-	-	-	-	-	1	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

### Assessment Pattern:

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	-	5	20
Analyze	5	10	10
Evaluate	10	5	20
Create	5	-	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**OE2118: Open Elective: Business Analytics**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Organize the knowledge of data analytics.
- 2 Demonstrate the ability of think critically in making decisions based on data and deep analytics.
- 3 Demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- 4 Formulate the ability to translate data into clear, actionable insights.

**Course Contents**

	<b>Hours</b>
<p><b>Unit 1 Business analytics:</b>            Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.  <b>Statistical Tools:</b> Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.</p>	(09)
<p><b>Unit 2 Trendiness and Regression Analysis:</b>            Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology</p>	(08)
<p><b>Unit 3 Organization Structures of Business analytics:</b>            Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization</p>	(09)
<p><b>Unit 4 Forecasting Techniques:</b>            Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.</p>	(10)
<p><b>Unit 5 Decision Analysis:</b>            Formulating Decision Problems, Decision Strategies with the without Outcome</p>	



Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. (08)

**Unit 6 Recent trends:**

Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism. (04)

**Text Books:**

- 1 Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications", Pearson FT Press, 2014.
- 2 James Evans, "Business Analytics", persons Education, 2<sup>nd</sup> edition, 2015.

**References:**

- 1 Jeffrey D. Camm , James J. Cochran , Michael J. Fry , Jeffrey W. Ohlmann , David R. Anderson, "Business Analytics", South-Western College Pub; 3<sup>rd</sup> edition,2018.
- 2 S. Christian Albright, Wayne L. Winston, "Business Analytics: Data Analysis & Decision Making" ,South-Western College Pub; 6th edition, 2016

**Useful Links:**

- 1 <https://nptel.ac.in/courses/110105089/> IIT Kharagpur

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	2	1	-	-	-	-	-	-	3	1
CO2	-	1	1	3	1	-	-	-	-	-	1	1
CO3	-	3	1	-	2	-	-	-	-	-	1	2
CO4	-	1	-	2	2	-	-	-	-	-	1	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	5
Apply	5	5	15
Analyze	5	10	15
Evaluate	10	-	20
Create	-	5	5
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**OE2128: Open Elective: Industrial Safety**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Plan and use of industrial safety techniques and fundamentals of industrial safety.
- 2 Appraise the periodic and preventive maintenance concepts.

**Course Contents**

	<b>Hours</b>
<p><b>Unit 1 Industrial safety:</b>            Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc., Safety colour codes. Fire prevention and firefighting, equipment and methods.</p>	(08)
<p><b>Unit 2 Fundamentals of maintenance engineering:</b>            Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost &amp; its relation with replacement economy, Service life of equipment.</p>	(06)
<p><b>Unit 3 Wear and Corrosion and their prevention:</b>            Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications: Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication Side feed lubrication, Ring lubrication, Definition, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.</p>	(10)
<p><b>Unit 4 Fault tracing:</b>            Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, Any one machine tool, Pump, Air compressor. Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.</p>	(10)
<p><b>Unit 5 Periodic and preventive maintenance:</b>            Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.</p>	(10)

**Unit 6 Steps/procedure for periodic and preventive maintenance of:** i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance (04)

**Text Books:**

- 1 Lester Coridon Morrow Lindley R. Higgins, "Maintenance engineering handbook", McGraw-Hill, 3<sup>rd</sup> edition, 1977.
- 2 H.P. Garg," Industrial Maintenance", S. Chand and Co; 3<sup>rd</sup> edition,1987.

**References:**

- 1 Audels, "Pump-hydraulic Compressors", McGraw Hill Publication.
- 2 Winterkorn, "Hans Foundation Engineering Handbook", Chapman & Hall London.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/110105094/> IIT Kharagpur
- 2 <https://nptel.ac.in/courses/112107143/> IIT Roorkee

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	2	-	-	1	3	-	-	1	1	1
CO2	-	-	3	-	-	1	1	-	-	1	1	1

1: Slight (Low)                      2: Moderate (Medium)                      3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	10
Analyze	5	5	20
Evaluate	5	5	20
Create	5	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**OE2138: Open Elective: Operations Research**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Apply the dynamic programming to solve problems of discrete and continuous variables.
- 2 Illustrate the concept of non-linear programming.
- 3 Formulate the sensitivity analysis.
- 4 Model the real-world problem and simulate it.

**Course Contents**

	<b>Hours</b>
<b>Unit I      Optimization Techniques:</b> Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.	(09)
<b>Unit II      Formulation of a LPP:</b> Graphical solution revised simplex method, duality theory, dual simplex method, sensitivity analysis, parametric programming	(08)
<b>Unit III      Nonlinear programming problem:</b> Kuhn-Tucker conditions min cost flow problem, max flow problem, CPM/PERT	(06)
<b>Unit IV      Scheduling and sequencing:</b> Single server and multiple server models, deterministic inventory models, Probabilistic inventory control models, Geometric Programming.	(09)
<b>Unit V      Competitive Models:</b> Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks,	(08)
<b>Unit VI      Graph Theory:</b> Elementary Graph Theory, Game Theory Simulation.	(04)

**Text Books:**

- 1 H.A. Taha, "Operations Research, An Introduction", PHI, 2008.
- 2 H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982.
- 3 J. C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008.

**References:**

- 1 Hitler Libermann "Operations Research", McGraw Hill Pub. 2009.
- 2 Pannerselvam, "Operations Research", Prentice Hall of India 2010.

3 Harvey M Wagner, “Principles of Operations Research”, Prentice Hall of India 2010.

**Useful Links:**

1 <https://nptel.ac.in/courses/110106062/> IIT Madras

2 <https://nptel.ac.in/courses/112106134/> IIT Madras

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	1	1	2	1	1	-	-	-	-	-	1	1
CO2	1	1	3	2	2	-	1	-	-	-	2	1
CO3	1	2	1	3	-	-	1	-	-	-	1	1
CO4	1	2	3	1	-	-	-	-	-	-	2	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	-	-
Apply	5	5	20
Analyze	5	5	20
Evaluate	5	5	10
Create	-	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**OE2148: Open Elective: Cost Management of Engineering Projects**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Develop the knowledge cost management process and project.
- 2 Organize Quantitative techniques for cost management.

**Course Contents**

	<b>Hours</b>
<p><b>Unit 1 Introduction and Overview of the Strategic Cost Management Process:</b>            Cost concepts in decision-making, Relevant cost, Differential cost, Incremental cost and Opportunity cost, Objectives of a Costing System, Inventory valuation, Creation of a Database for operational control, Provision of data for Decision-Making</p>	(09)
<p><b>Unit 2 Project:</b>            Meaning, Different types, why to manage, cost overruns centers, various stages of project  <b>Execution:</b> conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents</p>	(09)
<p><b>Unit 3 Project Team:</b>            Role of each member, Importance Project site, Data required with significance, Project contracts, Types and contents. Project execution Project cost control. Bar charts and Network diagram.</p>	(08)
<p><b>Unit 4 Project commissioning:</b>            Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing, Distinction between Marginal Costing and Absorption Costing, Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis.  <b>Pricing strategies:</b> Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector</p>	(10)
<p><b>Unit 5 Planning and Management:</b>            Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control, Flexible Budgets, Performance budgets, Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.</p>	(08)

**Unit 6 Quantitative techniques for cost management:**

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

(04)

**Text Books:**

- 1 “Cost Accounting A Managerial Emphasis”, Prentice Hall of India, New Delhi.
- 2 Charles T. Horngren and George Foster, “Management & Cost Accounting”.
- 3 Robert S Kaplan Anthony A. Alkinson, “Management & Cost Accounting”.

**References:**

- 1 Ashish K. Bhattacharya, “Principles & Practices of Cost Accounting”, A. H. Wheeler publisher.
- 2 N.D. Vohra, “Quantitative Techniques in Management”, Tata McGraw Hill Book Co. Ltd.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/105104161/8> IIT Kanpur

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	1	-	3	-	-	-	-	-	2	-	2	-
CO2	1	-	1	3	-	-	-	-	1	-	2	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	20
Analyze	5	5	10
Evaluate	5	5	10
Create	5	5	20
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**OE2158: Open Elective: Composite Materials**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Interpret the manufacturing of metal matrix composites.
- 2 Appraise the basics of Manufacturing of polymer matrix composites.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Introduction:</b> Definition, Classification and characteristics of Composite materials, Advantages and application of composites, Functional requirements of reinforcement and matrix, Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.	(09)
<b>Unit 2</b>	<b>Reinforcements:</b> Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures, Isostrain and Isostress conditions.	(08)
<b>Unit 3</b>	<b>Manufacturing of Metal Matrix Composites:</b> Casting: Solid State diffusion technique, Cladding: Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites, Liquid Metal Infiltration, Liquid phase sintering, Manufacturing of Carbon Carbon composites: Knitting, Braiding, Weaving. Properties and applications.	(10)
<b>Unit 4</b>	<b>Manufacturing of Polymer Matrix Composites:</b> Preparation of Molding compounds and prepregs, hand layup method, Autoclave method, Filament winding method, Compression molding, Reaction injection molding, Properties and applications	(07)
<b>Unit 5</b>	<b>Strength:</b> Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure, Laminate first ply failure-insight strength,	(09)
<b>Unit 6</b>	<b>Laminate strength</b> -ply discount truncated maximum strain criterion, strength design using caplet plots, Stress concentrations.	(04)



**Text Books:**

- 1 R.W.Cahn,” Material Science and Technology – Vol 13” Composites by VCH, West Germany.
- 2 WD Callister, Jr., Adapted by R. Balasubramaniam, “Materials Science and Engineering, An introduction”. John Wiley & Sons, NY, Indian edition, 2007.

**References:**

- 1 Lubin.” Hand Book of Composite Materials”.
- 2 K.K.Chawla. “Composite Materials”.
- 3 Deborah D.L. Chung “Composite Materials Science and Applications”.
- 4 Danial Gay, Suong V. Hoa, and Stephen W. Tasi.” Composite Materials Design and Applications”.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/101104010/> IIT Kanpur
- 2 <https://nptel.ac.in/courses/112104229/> IIT Kanpur

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	3	-	-	1	2	-	-	-	2	-
CO2	-	-	2	3	-	2	1	-	-	-	1	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	10
Analyze	5	5	20
Evaluate	5	5	10
Create	5	5	20
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**OE2168: Open Elective: Waste to Energy**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Sketch the use of waste to energy concepts.
- 2 Aware about Biomass, Biogas and its applications.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Introduction to Energy from Waste:</b> Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW, Conversion devices, Incinerators, gasifiers, digesters	(07)
<b>Unit 2</b>	<b>Biomass Pyrolysis:</b> Types, slow fast, Manufacture of charcoal, Methods, Yields and application, Manufacture of pyrolytic oils and gases, yields and applications	(08)
<b>Unit 3</b>	<b>Biomass Gasification:</b> Gasifiers , Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation, Gasifier burner arrangement for thermal heating, Gasifier engine arrangement and electrical power , Equilibrium and kinetic consideration in gasifier operation.	(09)
<b>Unit 4</b>	<b>Biomass Combustion:</b> Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.	(08)
<b>Unit 5</b>	<b>Biogas:</b> Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system, Design and constructional features, Biomass resources and their classification, Biomass conversion processes, Thermochemical conversion, Direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion , anaerobic digestion , Types of biogas Plants	(12)
<b>Unit 6</b>	<b>Applications:</b> Alcohol production from biomass, Bio diesel production and Urban waste to energy conversion, Biomass energy programme in India.	(04)

**Text Books:**

- 1 Desai, Ashok V , “Non-Conventional Energy”, Wiley Eastern Ltd., 1990

- 2 Khandelwal, K. C. and Mahdi, S. S., “Biogas Technology - A Practical Hand Book”, Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

**References:**

- 1 Challal, D. S Food, “Feed and Fuel from Biomass”, IBH Publishing Co. Pvt. Ltd., 1991.
- 2 C. Y. WereKo-Brobby and E. B. Hagan,” Biomass Conversion and Technology”, John Wiley & Sons, 1996.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/103107125/> IIT Roorkee.

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	3	-	-	-	1	1	2	2	1	2
CO2	-	-	-	-	-	-	1	1	2	3	1	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	20
Analyze	5	5	10
Evaluate	5	5	10
Create	5	5	20
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**AU2119: Audit Course – I: Research Paper Writing**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	2 Hrs/week	<b>MSE</b>	-
<b>Tutorial</b>	--	<b>ISE</b>	-
<b>Total Credits</b>	Audit	<b>ESE</b>	-

**Duration of ESE:**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Improve writing skills and level of readability.
- 2 Discriminate what to write in each section.
- 3 Upgrade the skills needed when writing a title.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Planning and Preparation:</b> Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	(04)
<b>Unit 2</b>	<b>Clarifying Who Did What:</b> Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	(04)
<b>Unit 3</b>	<b>Review of the Literature:</b> Methods, Results, Discussion, Conclusions, The Final Check.	(04)
<b>Unit 4</b>	<b>Key skills are needed when writing a Title:</b> key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature	(04)
<b>Unit 5</b>	<b>Skills are needed when writing the Methods:</b> skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	(04)
<b>Unit 6</b>	<b>Useful phrases:</b> how to ensure paper is as good as it could possibly be the first- time submission	(04)

**Text Books:**

- 1 Goldbort R, "Writing for Science", Yale University Press (available on Google Books) 2006.
- 2 Day R, "How to Write and Publish a Scientific Paper", Cambridge University Press, 2006.

**References:**

- 1 Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM, Highman's book, 1998.
- 2 Adrian Wallwork, "English for Writing Research Papers", Springer New York Dordrecht Heidelberg London, 2011.

**Useful Links:**

1 <https://nptel.ac.in/courses/109106094/34> IIT Madras

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	-	-	-	-	1	-	2	-	-	1
CO2	-	-	-	-	3	-	2	1	2	-	-	1
CO3	-	-	-	-	2	-	1	-	3	-	-	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**AU2129: Audit Course – I: Disaster Management**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	2 Hrs/week	<b>MSE</b>	-
<b>Tutorial</b>	--	<b>ISE</b>	-
<b>Total</b>	Audit	<b>ESE</b>	-
<b>Credits</b>			

**Duration of ESE:**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Illustrate key concepts in disaster risk reduction and humanitarian response.
- 2 Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- 3 Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Introduction:</b> Disaster: Definition, Factors and Significance, Difference Between Hazard And Disaster, Natural and Manmade Disasters: Difference, Nature, Types And Magnitude.	(04)
<b>Unit 2</b>	<b>Repercussions of Disasters And Hazards:</b> Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.	(04)
<b>Unit 3</b>	<b>Disaster Prone Areas in India Study of Seismic Zones:</b> Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards With Special Reference to Tsunami; Post-Disaster Diseases and Epidemics	(04)
<b>Unit 4</b>	<b>Disaster Preparedness and Management Preparedness:</b> Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness.	(04)
<b>Unit 5</b>	<b>Risk Assessment Disaster Risk:</b> Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Cooperation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival.	(04)
<b>Unit 6</b>	<b>Disaster Mitigation Meaning:</b> Concept And Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.	(04)

**Text Books:**

- 1 R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies”, New Royal Book company.
- 2 Sahni, Pardeep Et.Al. (Eds.),”Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.

**References:**

- 1 Goel S. L., “Disaster Administration And Management Text And Case Studies”, Deep & Deep Publication Pvt. Ltd., New Delhi.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/105104183> IIT Kanpur

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	2	2	-	1	-	-	1	-	2	1
CO2	-	1	2	1	-	1	-	-	1	-	2	1
CO3	-	1	2	1	-	1	-	-	1	-	1	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**AU2139: Audit Course – I: Sanskrit for Technical Knowledge**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	2 Hrs/week	<b>MSE</b>	-
<b>Tutorial</b>	--	<b>ISE</b>	-
<b>Total</b>	Audit	<b>ESE</b>	-
<b>Credits</b>			

**Duration of ESE:**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Demonstrate the basic Sanskrit language.
- 2 Acquire the knowledge of ancient Sanskrit literature about science & technology.
- 3 Being a logical language that will help to develop logic in students.

**Course Contents**

	<b>Hours</b>
<b>Unit 1</b> Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.	(04)
<b>Unit 2</b> Order, Introduction of roots.	(04)
<b>Unit 3</b> Technical information about Sanskrit Literature.	(04)
<b>Unit 4</b> Technical concepts of Engineering-Electrical.	(04)
<b>Unit 5</b> Technical concepts of Engineering - Mechanical, Architecture.	(04)
<b>Unit 6</b> Technical concepts of Engineering – Mathematics.	(04)

**Text Books:**

- 1 Dr. Vishwas, “Abhyaspustakam”, Samskrita-Bharti Publication, New Delhi.
- 2 Prathama Deeksha-Vempati Kutumbshastri, “Teach Yourself Sanskrit”, Rashtriya Sanskrit Sansthanam, New Delhi Publication.

**References:**

- 1 Suresh Soni, “India’s Glorious Scientific Tradition”, Ocean books (P) Ltd., New Delhi.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/109105135/> IIT Kharagpur



**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	1	-	1	2	-	-	1	1	-	-	1	-
CO2	1	-	2	1	-	-	1	1	-	-	1	-
CO3	1	-	1	1	-	-	1	2	-	-	1	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**  
**AU2149: Audit Course – I: Value Education**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	2 Hrs/week	<b>MSE</b>	-
<b>Tutorial</b>	--	<b>ISE</b>	-
<b>Total</b>	Audit	<b>ESE</b>	-
<b>Credits</b>			

**Duration of ESE:**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Acquire the knowledge of self-development.
- 2 Learn the importance of Human values.
- 3 Developing the overall personality.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Values and self-development:</b> Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, Value judgments.	(04)
<b>Unit 2</b>	<b>Importance of cultivation of values:</b> Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline.	(04)
<b>Unit 3</b>	<b>Personality and Behavior Development:</b> Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance.	(04)
<b>Unit 4</b>	<b>True friendship:</b> Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature.	(04)
<b>Unit 5</b>	<b>Character and Competence:</b> Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence, Humility.	(04)
<b>Unit 6</b>	<b>Role of Women:</b> All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively.	(04)

**Text Books:**

- 1 Chakroborty, S.K., “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

**References:**

- 1 Saxena A, “Human Values And Professional Ethics”, Value Education Of India, 2012

**Useful Links:**

- 1 <https://nptel.ac.in/courses/109104068/> IIT Kanpur

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	1	-	2	1	-	-	2	1	2	-	-	1
CO2	1	-	2	1	-	-	2	1	1	-	-	1
CO3	1	-	1	2	-	-	2	1	2	-	-	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**  
**CS2201: Advanced Computer Networks**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3 Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Illustrate the basic concepts of internetworking.
- 2 Appraise the software defined network.
- 3 Describe fundamentals of storage network and management.

**Course Contents**

	<b>Hours</b>
<b>Unit 1</b> <b>Internetworking:</b> Routing Algorithms, Congestion Control, Quality of Service, Queue Management, High Speed Networks, Performance Modeling and Estimation.	(06)
<b>Unit 2</b> <b>IPv6:</b> IPv4 deficiencies, patching work done with IPv4, IPv6 addressing, multicast, Anycast, ICMPv6, Neighbour discovery, Routing	(08)
<b>Unit 3</b> <b>Software Defined Networking and OpenFlow:</b> Centralized and Distributed Control and Data Planes, SDN Controllers, Data Center Concepts, Network Function Virtualization, Mininet, Programming SDNs, Openflow Switch, Wire Protocol, Openstack Neutron plug-in.	(09)
<b>Unit 4</b> <b>Ad Hoc Wireless Networks:</b> MAC Protocols for Ad Hoc Wireless Networks, Routing Protocols for Ad Hoc Wireless Networks, Multicast routing in Ad Hoc Wireless Networks, Transport Layer and Security Protocols for Ad Hoc Wireless Networks, Quality of Service in Ad Hoc Wireless Networks.	(10)
<b>Unit 5</b> <b>Network management Protocols:</b> SNMPv1 Network Management: Organization and Information Models, SNMPv2: major changes, SNMPv3, RMON, Network Management Tools, Systems, and Engineering, Network Management Applications	(10)
<b>Unit 6</b> <b>Storage and Networking:</b> Storage and Networking Concepts, Fiber Channel Internals, Fiber Channel SAN Topologies, Fiber Channel Products, IP SAN Technology, IP SAN Products, Management of SANs, SAN Issues	(05)

**Text Books:**

- 1 William Stallings, "High-Speed Networks and Internets", Pearson Education, 2<sup>nd</sup> Edition, 2002.
- 2 Thomas D Nadeau, Ken Grey, "Software Defined Networking", O'Reilly, 2013.
- 3 Pete Loshin, "IPv6, Theory, Protocols and Practice", Morgan Kaufmann, 2<sup>nd</sup> Edition, 2004.

**References:**

- 1 Mani Subramanian, Timothy A. Gonsalves, N. Usha Rani, "Network Management: Principles

- and Practice”, Pearson Education India, 2010.
- 2 C. Siva Ram Murthy, B.S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Prentice Hall, 2004.
  - 3 B. Muthukumaran, “Introduction to High Performance Networks”, Tata Mc Graw Hill, 2008.
  - 4 Tom Clark, “Designing Storage Area Networks, A Practical Reference for Implementing Fibre Channel and IP SANs”, Addison-Wesley Professional, 2<sup>nd</sup> Edition, 2003.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106105160/>
- 2 <https://nptel.ac.in/courses/106108058/>

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	1	-	2	-	-	-	-	-	-	1	1	1
CO2	1	2	2	2	-	-	-	-	-	1	1	1
CO3	1	2	-	2	-	-	-	-	1	1	1	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	-	-
Apply	5	5	20
Analyze	5	5	10
Evaluate	5	5	10
Create	-	5	20
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**  
**CS2202: Soft Computing**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3 Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Identify and describe soft computing techniques and their roles in building intelligent machines
- 2 Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
- 3 Apply genetic algorithms to combinatorial optimization problems.
- 4 Evaluate and compare solutions by various soft computing approaches for a given problem.

**Course Contents**

	<b>Hours</b>
<b>Unit 1</b> <b>Introduction to soft computing and neural Networks:</b> Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.	(07)
<b>Unit 2</b> <b>Fuzzy logic:</b> Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.	(08)
<b>Unit 3</b> <b>Neural networks:</b> 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.	(10)
<b>Unit 4</b> <b>Genetic algorithms:</b> Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.	(05)
<b>Unit 5</b> <b>Matlab/Python Lib:</b> Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.	(13)
<b>Unit 6</b> <b>Recent Trends</b> in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.	(05)

**Text Books:**

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

**References:**

- 1 Sivanandam & Deepa, “Principles of Soft Computing”, Wiley India.
- 2 S. Rajasekaram & G.A. Vijyalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI.
- 3 MATLAB Toolkit Manual.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106105173/> IIT Kharagpur

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	1	-	-	-	-	-	1	-	1	1
CO2	-	2	1	1	-	-	-	-	-	-	1	1
CO3	-	2	1	1	-	-	-	-	1	-	1	1
CO4	1	-	-	-	-	-	-	-	-	-	1	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	20
Analyze	5	5	15
Evaluate	5	5	10
Create	5	5	15
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**  
**CS2206: Laboratory 3 (Based on Cores)**

<b>Laboratory Scheme</b>		<b>Examination Scheme</b>	
<b>Practical</b>	4 Hrs/week	<b>ISE</b>	25
<b>Total</b>	2	<b>ESE</b>	25
<b>Credits</b>			

**Course Outcome(CO):** After completion of course, students will be able to:

- 1 Configure and implement different servers and protocols.
- 2 Design real world application using soft computing techniques.

**Course Contents**

**Advanced Computer Networks**

- Experiment 1** Introduction to the basic router configuration and basic commands. Configuration and logging to a CISCO router and introduction to the basic user interfaces.
- Experiment 2** Configuration of IP addressing for a given scenario for a given set of topologies.
- Experiment 3** Configure a DHCP server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS binaries based on client MAC address.
- Experiment 4** Configure, implement and debug the following: Use open source tools for debugging and diagnostics. a. ARP/RARP protocols b. RIP routing protocols c. BGP routing d. OSPF routing protocols e. Static routes (check using netstat).
- Experiment 5** Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down.
- Experiment 6** Configure FTP server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb. Use a TFTP client and repeat the experiment.
- Experiment 7** Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.
- Experiment 8** Implement Open NMS+ SNMPD for checking device status of devices in community MIB of a linux PC using yellow pages and NIS/NFS protocols.
- Experiment 9** Implement Network Attached Storage Controller (NAS). Extend this to serve a windows client using SMB. Characterise the NAS traffic using wireshark.

**Soft Computing**

- Experiment 10** Write a program to implement Fuzzy Operations.
- Experiment 11** Write a program to implement Simple Neural Network
- Experiment 12** Write a program to implement Perceptron Learning Algorithm
- Experiment 13** Write a program to implement Unsupervised Learning Algorithm
- Experiment 14** Write a program to implement Simple Genetic Application
- Experiment 15** Write a program for Back propagation Algorithm
- Experiment 16** Study of Soft Computing tools.
- Experiment 17** A Mini project: may include classification or regression problem, using any soft computing technique

**List of Submission:**

2. Total number of Experiments : 16





**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**  
**CS2207: Laboratory 4 (Based on Elective III & IV)**

<b>Laboratory Scheme</b>		<b>Examination Scheme</b>	
<b>Practical</b>	4 Hrs/week	<b>ISE</b>	50
<b>Total</b>	2	<b>ESE</b>	--
<b>Credits</b>			

**Course Outcome(CO):** After completion of course, students will be able to:

- 1 Explain the basics of data preparation and analysis.
- 2 Design scalable, fault-tolerant cloud infrastructure with data-center architecture and load balancing.
- 3 Perform operations on image, face detection and face recognition.
- 4 Create HCI applications.
- 5 Demonstrate GPU implementation of Matrix-Matrix operations.
- 6 Explain digital forensics concepts.

**Course Contents**

**Group A - Data Preparation and Analysis**

- Experiment 1** Installation of Python, Pandas and NumPy.  
**Experiment 2** Write a program to perform data gathering and preparation methods.  
**Experiment 3** Write a program to perform data wrangling techniques.  
**Experiment 4** Write a program to perform data cleaning operations.  
**Experiment 5** Create an application to visualize data using Python.  
**Experiment 6** Write a program to perform exploratory analysis in Python using Pandas.

**Group B - Cloud Computing and Applications Lab**

- Experiment 7** Simulate cloud scenarios using CloudSim to study scalability, performance, and quality of service (QoS) aspects.  
**Experiment 8** Explore data-center architectures and design a scalable and fault-tolerant infrastructure for cloud applications.  
**Experiment 9** Simulate cloud scenarios using CloudSim to study security mechanisms and protocols.  
**Experiment 10** Set up a private cloud environment using open-source solutions like OpenStack or Kubernetes to understand cloud architectures.  
**Experiment 11** Implement a continuous integration and continuous deployment (CI/CD) pipeline for a cloud-based application.  
**Experiment 12** Containerize an application using Docker and deploy it on a Kubernetes cluster for orchestration.

**Group C - Computer Vision**

- Experiment 13** Installation of Python and OpenCV.  
**Experiment 14** Write a program to draw shapes and writing text on an image.  
**Experiment 15** Write a program for image segmentation using colour spaces in OpenCV and Python.  
**Experiment 16** Write a program for face detection in Python using a Webcam.  
**Experiment 17** Write a program to load a video and save a video in a different format.  
**Experiment 18** Write a program for face recognition in Python using a webcam.

**Group D - Human Computer Interaction**

- Experiment 19** To understand the trouble of interacting with machines - Redesign interfaces of home appliances.  
**Experiment 20** Write a program to design a system based on user centred approach.  
**Experiment 21** Write a program to design web user interface based on Gestalt Theory.  
**Experiment 22** Create application for speech recognition.



**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**  
**CS2208: Seminar**

<b>Laboratory Scheme</b>		<b>Examination Scheme</b>	
<b>Practical</b>	4Hrs/week	<b>ISE</b>	<b>100</b>
<b>Total</b>	<b>2</b>	<b>ESE</b>	<b>--</b>

**Credits**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Explore the information about recent trends in relevant field.
- 2 Identify the research area in computer science and engineering.
- 3 Prepare and present research work.

**Course Contents**

Seminar should be based on the literature survey on any topic relevant to computer science and engineering. It may be leading to selection of a suitable topic of dissertation. Each student has to prepare a write up of about 25 pages. The report typed on A4 sized sheets and bound in necessary format should be submitted after approved by the guide and endorsement of Head of Department. The student has to deliver a similar talk in front of the faculty of the department and the students. The assessment of the seminar will be based on the quality of work, preparation and understanding of the candidate, depth of knowledge and presentation skills. The assessment of the seminar will be done by the panel of faculty members.

Students should deliver seminar individually. It should consist of a talk of 30 minutes on a topic preferably from the area in which a student intends to work for his project work in final year M. Tech or any upcoming technology not covered in syllabus.

**Selection of Seminar Topic**

1. Select a seminar topic relevant to Computer Science and Engineering. For selection topics refer Scopus Index Journal papers and innovative ideas.
2. Get the topic approved by the seminar guide well in advance.

**Preparation**

1. Research the topic well. Find relevant information related to topic.
2. The presentation slides should include list of key points, figures, charts and tables. There should not be running paragraphs.
3. The slides should be readable – Font size used should be at least 20.
4. The figures, tables etc. should be relevant to content and should not be for only namesake.
5. Figures should be very clear. Develop the habit of drawing your own figures using suitable software tools for better clarity.
6. For the presentation, adopt simple themes; avoid unnecessary animation and sound effects.
7. The presentation should be approved by the seminar guide for corrections if any.
8. A report of the seminar should contain the following and report should be prepared by using Latex.
  - a. Title of the seminar.
  - b. Abstract of the topic.
  - c. Name and other details of student and the guide.
  - d. List of references strictly in IEEE format.

**Presentation**

1. Keep a hand-out of presentation. This will help organize the talk better.
2. There should be proper self-introduction at the beginning.
3. Introduce the topic and highlight its significance.
4. Have good voice projection; deliver in modest pace; modulation of voice is desirable.
5. Keep eye contact with the audience.
6. Face the audience – Don't talk to the screen.
7. Familiarise with presentation aids.
8. Avoid repeated use of certain words/gestures.
9. Give a proper conclusion.

**Assessment Guideline:**

- Student has to meet weekly to the guide and whereas guide has to keep track on the progress of the seminar and also has to maintain attendance report. This progress report can be used for awarding CA marks.
- The seminar to be delivered by students should be assessed by a panel of at least two senior faculties within the department.
- The assessment for the seminar should include but not limited to following points.
  - 1) Novelty of the topic
  - 2) Technical depth
  - 3) Organization of the topic
  - 4) Presentation skills
  - 5) Communication skills
  - 6) Question-Answer session

**List of Submission:**

1. Seminar report should be prepared using Latex.

**Mapping of COs and POs:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	-	-	1	2	1	3	3	-	1	3
CO2	-	-	-	-	1	2	2	3	3	-	1	3
CO3	-	-	-	-	1	2	1	3	3	-	1	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**  
**CS2213: Program Elective III: Data Preparation and Analysis**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3 Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Extract the data for performing the Analysis

**Course Contents**

	<b>Hours</b>
<b>Unit 1 Defining data analysis problems:</b> Knowing the client, understanding the questions.	(04)
<b>Unit 2 Data Gathering and Preparation:</b> Data formats, parsing and transformation, Scalability and real-time issues	(09)
<b>Unit 3 Data Cleaning:</b> Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation	(09)
<b>Unit 4 Exploratory Analysis:</b> Descriptive and comparative statistics, Clustering and association, Hypothesis generation	(10)
<b>Unit 5 Visualization:</b> Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity	(10)
<b>Unit 6 Modelling tools and Data Preparation:</b> How Modelling tools drive data preparation, Decision trees, decision Lists, Neural Networks, Evolution Programs, Modelling data with tools, Missing Data and Modelling tools.	(06)

**Text Books:**

- 1 Glenn J. Myatt, "Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining", Wiley-Blackwell, 2016
- 2 Dorian Pyle, "Data Preparation for Data Mining", Morgan Kaufmann; 1<sup>st</sup> edition, 1999.

**References:**

- 1 Anil Maheshwari, "Data Analytics", McGraw Hill Education; 1<sup>st</sup> edition, 2017.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/110104068/> IIT Kanpur
- 2 <https://nptel.ac.in/courses/110107080/> IIT Roorkee

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	1	2	2	-	-	-	-	-	2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	5	-
Apply	5	5	15
Analyze	5	5	10
Evaluate	5	5	15
Create	5	-	20
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**  
**CS2223: Program Elective-III: Cloud Computing and Applications**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total Credits</b>	<b>3</b>	<b>ESE</b>	60

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

1. Apply virtual machine migration and load balancing strategies to optimize resource utilization.
2. Design cloud architectures, including federated clouds, to meet specific application requirements.
3. Utilize containerization technologies like Docker and Kubernetes for efficient application deployment.
4. Analyze real-world case studies of cloud computing systems from major providers, evaluating their design and impact.

**Course Contents**

	<b>Hours</b>
<b>Unit 1 Fundamentals of Cloud Computing:</b> Fundamental concepts and Models, Characteristics of cloud computing, Cloud deployment models: Public, Private, Hybrid clouds, Cloud delivery models: IaaS, PaaS, SaaS, Cloud benefits, challenges, and risks rate.	(06)
<b>Unit 2 Enabling Technologies and System Models for Cloud Computing:</b> Data-center architectures for cloud computing, virtualization technology, Virtual machine migration and load balancing, , CloudSim: Simulation tools for cloud computing, Scalability, performance, and QoS in cloud computing.	(10)
<b>Unit 3 Cloud Computing Service Models and Architectures:</b> Infrastructure/Platform/Software-as-a-service models, Cloud architectures, including federated clouds, Cloud economics and capacity planning, Disaster recovery in cloud computing.	(08)
<b>Unit 4 Security, Privacy, and Risk Management in Cloud:</b> Security and privacy issues in cloud computing, Identity and access management, Cloud vendor management and selection, Security mechanisms and protocols, VMWare ESX Memory Management.	(08)
<b>Unit 5 Cloud Application Development and DevOps:</b> Cloud-based application architecture, Micro services and containerization (e.g., Docker, Kubernetes) DevOps practices in the cloud, Server less computing and edge computing, Quantum computing and its implications for the cloud	(10)



**Unit 6 Case Studies and Emerging Trends:**

In-depth case studies of cloud computing systems, Emerging trends in cloud technology, Edge computing and its applications, (case study of cloud systems from Amazon, Microsoft, and IBM).

(05)

**Text Books:**

1. Thomas Erl\_ Zaigham Mahmood\_ Ricardo Puttini – “Cloud Computing\_ Concepts, Technology & Architecture” -Prentice Hall (2013)
2. Tim Mather, Subra Kumaraswamy, Shahed Latif - Cloud Security and Privacy\_ An Enterprise Perspective on Risks and Compliance (Theory in Practice)-O'Reilly Media (2009)

**References:**

- 1 Guthrie, Forbes\_Liebowitz, Matt\_Atwell, Josh\_Marshall, Nick\_Lowe, Scott - Mastering VMware vSphere-John Wiley & Sons (2013)
- 2 Kevin Jackson - OpenStack Cloud Computing Cookbook-Packt Publishing (2012)
- 3 Nigel Poulton - Docker Deep Dive-Independently published (2018-02-11)
- 4 Rajkumar Buyya, James Broberg, Andrzej M. Goscinski - Cloud Computing Principles and Paradigms (Wiley Series on Parallel and Distributed Computing)-Wiley (2011).

**Useful Links:**

- 1 [https://onlinecourses.nptel.ac.in/noc23\\_cs89/preview](https://onlinecourses.nptel.ac.in/noc23_cs89/preview)
- 2 <https://www.geeksforgeeks.org/what-is-cloudsim/>
- 3 [https://onlinecourses.nptel.ac.in/noc23\\_cs90/preview](https://onlinecourses.nptel.ac.in/noc23_cs90/preview)
- 4 <https://www.openstack.org/passport/>
- 5 <https://docs.vmware.com/>
- 6 <https://www.lambdatest.com/learning-hub/cicd-testing>

**Mapping of COs and POs:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	-	-	-	-	1	-	-	-	-	2	1
CO2	-	3	2	-	-	2	-	-	-	-	2	1
CO3	-	-	3	3	-	2	-	-	-	-	2	1
CO4	-	-	-	3	-	2	-	-	-	-	2	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	5
Apply	5	5	15
Analyze	5	5	20
Evaluate	-	-	10
Create	5	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**  
**CS2233: Program Elective-III: Computer Vision**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3 Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Develop the practical skills necessary to build computer vision applications.
- 2 Exposure to object and scene recognition and categorization from images.

**Course Contents**

	<b>Hours</b>
<b>Unit 1</b> <b>Overview:</b> computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis	(08)
<b>Unit 2</b> <b>Edge detection:</b> Edge detection performance, Hough transform, corner detection	(09)
<b>Unit 3</b> <b>Segmentation:</b> Morphological filtering, Fourier transform	(09)
<b>Unit 4</b> <b>Feature extraction:</b> shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing	(09)
<b>Unit 5</b> <b>Pattern Analysis:</b> Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.	(09)
<b>Unit 6</b> <b>Recent trends</b> in Activity Recognition, computational photography, Biometrics.	(04)

**Text Books:**

- 1 Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer;1<sup>st</sup> edition, 2011
- 2 Goodfellow, Bengio, Courville, “Deep Learning”, MIT Press, 2017

**References:**

- 1 Robert B. Fisher Toby P. Breckon ,Kenneth Dawson-Howe , Andrew Fitzgibbon , Craig Robertson, “Dictionary of Computer Vision and Image Processing”, Wiley-Blackwell; 2<sup>nd</sup> edition, 2013

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106106090/> IIT Madras
- 2 <https://nptel.ac.in/courses/106102065/> IIT Delhi
- 3 <https://nptel.ac.in/courses/106102063/> IIT Delhi

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	1	2	1	-	-	-	-	-	1	1
CO2	-	1	1	1	2	-	-	-	-	-	2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	10
Analyze	5	5	20
Evaluate	5	5	20
Create	5	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-I) M. Tech. Computer Science & Engineering**

**CS2214: Program Elective-IV: Human Computer Interaction**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Illustrate the structure of models and theories of human computer interaction and vision.
- 2 Design an interactive web interface on the basis of models studied.

**Course Contents**

	<b>Hours</b>
<b>Unit 1</b> <b>Human: I/O channels:</b> Memory reasoning and problem solving; The computer: Devices: Memory processing and networks; Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms.	(09)
<b>Unit 2</b> <b>Interactive Design basics:</b> process, scenarios, navigation, screen design, Iteration and prototyping. HCI in software process, software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules, principles, standards, guidelines, rules. Evaluation Techniques, Universal Design.	(12)
<b>Unit 3</b> <b>Cognitive models:</b> Socio-Organizational issues and stake holder requirements, Communication and collaboration models, Hypertext, Multimedia and WWW.	(08)
<b>Unit 4</b> <b>Mobile Ecosystem:</b> Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	(08)
<b>Unit 5</b> <b>Designing Web Interfaces:</b> Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	(08)
<b>Unit 6</b> <b>Recent Trends:</b> Speech Recognition and Translation, Multimodal System	(03)

**Text Books:**

- 1 Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3<sup>rd</sup> Edition, Pearson Education, 2004. (UNIT I, II & III)
- 2 Brian Fling, "Mobile Design and Development", 1<sup>st</sup> Edition, OReilly Media Inc., 2009. (UNIT – IV)
- 3 Bill Scott, Theresa Neil, "Designing Web Interfaces", 1<sup>st</sup> Edition, OReilly, 2009. (UNIT-V, VI)

**References:**

- 1 Dix, "Human-Computer Interaction", Pearson Education India 3<sup>rd</sup> Edition, 2004
- 2 Meena K, "Human Computer Interaction", Prentice Hall India Learning Private Limited, 2014

**Useful Links:**

1 <https://nptel.ac.in/courses/106106177/> IIT MADRAS

2 <https://nptel.ac.in/courses/106103115/> IIT GUWAHATI

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	1	2	1	-	-	-	1	-	2	1
CO2	-	1	1	2	1	-	-	-	1	-	2	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	20
Analyze	5	5	10
Evaluate	5	5	10
Create	5	5	20
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**  
**CS2224: Program Elective-IV: GPU Computing**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3 Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Interpret the concepts in parallel programming.
- 2 Implement the programs on GPUs, debugging and profiling parallel programs

**Course Contents**

	<b>Hours</b>
<b>Unit 1 Introduction:</b> History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU and GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL, Open ACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps, Wave fronts, Thread blocks, Workgroups, Streaming multiprocessors, 1D, 2D, 3D thread mapping, Device properties, Simple Programs.	(13)
<b>Unit 2 Memory:</b> Memory hierarchy, DRAM, global, local, shared, private, local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories.	(07)
<b>Unit 3 Synchronization:</b> Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU <b>Functions:</b> Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.	(10)
<b>Unit 4 Support:</b> Debugging GPU Programs. Profiling, Profile tools, Performance aspects <b>Streams:</b> Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based-Synchronization – Overlapping data transfer and kernel execution, pitfalls.	(08)
<b>Unit 5 Case Studies:</b> Image Processing, Graph algorithms, Simulations, Deep Learning	(05)
<b>Unit 6 Advanced topics:</b> Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing	(05)

**Text Books:**

- 1 David Kirk, Wen-mei Hwu, Morgan Kaufman, “Programming Massively Parallel Processors: A Hands-on Approach”, 2010. (ISBN: 978-0123814722)
- 2 Shane Cook, Morgan Kaufman, “CUDA Programming: A Developer’s Guide to Parallel

Computing with GPUs”, 2012. (ISBN: 978-0124159334)

**References:**

- 1 David Kirk, Wen-mei Hwu, “Programming Massively Parallel Processors: A Hands-on Approach”, Morgan Kaufman; 2010 (ISBN: 978-0123814722)
- 2 Shane Cook, “CUDA Programming: A Developer’s Guide to Parallel Computing with GPUs”,Morgan Kaufman; 2012 (ISBN: 978-0124159334)

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106102114/> IIT Delhi
- 2 <https://nptel.ac.in/courses/106104120/> IIT Kanpur

**Mapping of Cos and Pos:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	2	2	2	1	-	-	-	-	1	1	1
CO2	-	2	3	2	-	-	-	-	-	1	-	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember			
Understand	5		
Apply	5	5	20
Analyze	5	5	20
Evaluate	5	5	10
Create		5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**

**CS2234: Program Elective-IV: Digital Forensics**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	60
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Apply relevant legislation and codes of ethics.
- 2 Appraise computer forensics and digital detective and various processes, policies and procedures.
- 3 Formulate the concepts of E-discovery, guidelines and standards, E-evidence, tools and environment.
- 4 Interpret Email and web forensics and network forensics.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Digital Forensics Science:</b> Forensics science, computer forensics, and digital forensics. <b>Computer Crime:</b> Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics	(09)
<b>Unit 2</b>	<b>Cyber Crime Scene Analysis:</b> Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation	(08)
<b>Unit 3</b>	<b>Evidence Management &amp; Presentation:</b> Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.	(09)
<b>Unit 4</b>	<b>Computer Forensics:</b> Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, <b>Network Forensics:</b> open-source security tools for network forensic analysis, requirements for preservation of network data.	(10)
<b>Unit 5</b>	<b>Mobile Forensics:</b> mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008	(08)
<b>Unit 6</b>	<b>Recent trends</b> in mobile forensic technique and methods to search and seizure electronic evidence	(04)



**Text Books:**

- 1 John Sammons, “The Basics of Digital Forensics”, Syngress; 2<sup>nd</sup> edition, 2014
- 2 John Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Laxmi Publications, 1<sup>st</sup> edition 2015

**References:**

- 1 Alex Samm , Dale Joseph, Shiva V. N Parasram, “Digital Forensics with Kali Linux: Perform data acquisition, digital investigation, and threat analysis using Kali Linux tools ”,Packt Publishing Limited 2017
- 2 Nilakshi Jain, Dhananjay R. Kalbande, “Digital Forensic: The Fascinating World of Digital Evidences”, Wiley. 2016

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106106178/> IIT MADRAS
- 2 <https://nptel.ac.in/courses/106106129/> IIT MADRAS

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	2	1	-	-	-	-	1	-	1	3
CO2	-	-	1	2	3	-	-	-	2	-	1	1
CO3	-	-	2	3	-	-	-	-	3	-	1	-
CO4	-	-	1	1	-	-	-	-	2	-	1	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	15
Analyze	5	5	10
Evaluate	5	5	15
Create	5	5	20
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**  
**CS2215: Program Elective-V: Mobile Technologies and Services**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Identify the target platform and users and be able to define and sketch a mobile application.
- 2 Interpret the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android, and PhoneGap.
- 3 Design and develop a mobile application prototype in one of the platform.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Introduction to Mobile Computing:</b> Introduction:, Introduction to Android, Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User	(08)
<b>Unit 2</b>	<b>More on Uis:</b> VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis. Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider	(08)
<b>Unit 3</b>	<b>Communications via Network and the Web:</b> State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics	(10)
<b>Unit 4</b>	<b>Putting It All Together:</b> Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia	(09)
<b>Unit 5</b>	<b>Platforms and Additional Issues:</b> Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions, More on Security, Hacking Android	(08)
<b>Unit 6</b>	<b>Recent Trends:</b> Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT	(05)

**Text Books:**

- 1 Wei-Meng Lee, “Beginning Android™ 4 Application Development”, John Wiley & Sons, 2012.

**References:**

- 1 Pradeep Kothari , “Android Application Development Black book”, Dreamtech Press, 2014.
- 2 Kloss, “Android Apps With App Inventor”, Pearson Education, 1<sup>st</sup> edition, 2013.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106106156> IIT Madras

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	1	2	-	-	-	-	-	-	2	1
CO2	-	1	-	2	-	-	-	-	-	-	2	1
CO3	-	2	1	2	-	-	-	-	-	-	2	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	5	5
Apply	5	5	20
Analyze	5	5	20
Evaluate	5	5	10
Create	5	-	5
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**

**CS2225: Program Elective-V: Compiler for HPC**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Illustrate the structure of compiler.
- 2 Understand parallel loops, data dependency and exception handling and debugging in compiler.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>High Performance Systems:</b> Structure of a Compiler, Programming Language, Features, Languages for High Performance	(07)
<b>Unit 2</b>	<b>Data Dependence:</b> Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph. Scalar Analysis with Factored Use-Def Chains: Constructing Factored Use-Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays.	(07)
<b>Unit 3</b>	<b>Loop Restructuring and Optimization for Locality:</b> Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis. Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations, Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality.	(10)
<b>Unit 4</b>	<b>Concurrency Analysis:</b> Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers	(10)
<b>Unit 5</b>	<b>Message-Passing Machines:</b> SIMD Machines, MIMD Machines, Data Layout, Parallel Code for Array Assignment, Remote Data Access, Automatic Data Layout. Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines	(10)

**Unit 6 Recent Trends:**

Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine.

(04)

**Text Books:**

- 1 Michael Wolfe, “High-Performance Compilers for Parallel Computing”, Pearson, 1<sup>st</sup> edition.

**References:**

- 1 Kevin Dowd, “High Performance Computing”, O’Reilly Media, 1<sup>st</sup> edition.
- 2 John Levesque, Gene Wagenbreth, “High Performance Computing: Programming and Applications”, Chapman and Hall/CRC, 1<sup>st</sup> edition, 2010.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/106108055/> IISC Bangalore

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	2	-	1	-	-	-	-	1	1	1
CO2	-	1	2	-	1	-	-	-	-	-	2	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	-	-
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	20
Create	-	5	20
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**

**CS2235: Program Elective-V: Optimization Techniques**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	3Hrs/week	<b>MSE</b>	20
<b>Tutorial</b>	--	<b>ISE</b>	20
<b>Total</b>	<b>3</b>	<b>ESE</b>	<b>60</b>
<b>Credits</b>			

**Duration of ESE: 2 Hrs 30 Min**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Formulate optimization problems.
- 2 Apply the concept of optimality criteria for various types of optimization problems.
- 3 Solve various constrained and unconstrained problems in Single variable as well as multivariable.
- 4 Apply the methods of optimization in real life situation.

**Course Contents**

	<b>Hours</b>
<b>Unit 1    Optimization:</b> Engineering application of Optimization, Formulation of design problems as mathematical programming problems.	(07)
<b>Unit 2    Optimization Algorithms:</b> General Structure of Optimization Algorithms, Constraints, The Feasible Region	(07)
<b>Unit 3    Branches of Mathematical Programming:</b> Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.	(11)
<b>Unit 4    Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.</b>	(12)
<b>Unit 5    Real life Problems and their mathematical formulation as standard programming problems.</b>	(06)
<b>Unit 6    Recent trends:</b> Applications of ant colony optimization, genetics and linear and quadratic programming in real world applications.	(05)

**Text Books:**

- 1 Laurence A. Wolsey, "Integer programming" Wiley publication, ISBN978-0-471-28366-9, 1998.
- 2 Andreas Antoniou, Wu-Sheng Lu, "Practical Optimization Algorithms and Engineering Applications", Springer.
- 3 Edwin K., P. Chong, Stanislaw h. Zak, "An Introduction to Optimization", 4<sup>th</sup> edition, Wiley publication.

**References:**

- 1 Dimitris Bertsimas, Robert Weismantel, “Optimization over integers”, Dynamic Ideas, ISBN 978-0-9759146-2-5, 2005
- 2 John K. Karlof, “Integer programming: theory and practice”, CRC Press, ISBN 978-0-8493-1914-3, 2006.
- 3 H. Paul Williams, “Logic and Integer Programming” Springer, ISBN 978-0-387-92279-9, 2009.
- 4 Michael Jünger, Thomas M. Liebling, Denis Naddef, George Nemhauser, William R. Pulleyblank, Gerhard Reinelt, Giovanni Rinaldi, Laurence A. Wolsey, and eds., “50 Years of Integer Programming” 1958-2008: From the Early Years to the State-of-the- Art. Springer, ISBN 978-3- 540-68274-5, 2009.
- 5 Der-San Chen, Robert G. Batson, Yu Dang, “Applied Integer Programming: Modeling and Solution”, John Wiley and Sons, ISBN 978-0-470-37306-4, 2010.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/111105039/> IIT Kharagpur

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	1	1	3	1	-	-	-	-	-	1	2
CO2	-	2	1	-	1	-	-	-	-	-	1	2
CO3	-	1	3	1	2	-	-	-	-	-	1	1
CO4	-	2	-	1	3	-	-	-	-	-	1	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Assessment Pattern:**

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	-
Apply	5	5	10
Analyze	5	5	20
Evaluate	5	5	20
Create	5	5	10
Total	20	20	60

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**

**AU2219: Audit Course – II: Constitution of India**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	2 Hrs/week	<b>MSE</b>	-
<b>Tutorial</b>	--	<b>ISE</b>	-
<b>Total</b>	Audit	<b>ESE</b>	-
<b>Credits</b>			

**Duration of ESE:**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Formulate the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- 2 Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- 3 Rewrite the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- 4 Construct the passage of the Hindu Code Bill of 1956.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>History of Making of the Indian Constitution:</b> History Drafting Committee, (Composition & Working)	(04)
<b>Unit 2</b>	<b>Philosophy of the Indian Constitution:</b> Preamble Salient Features	(04)
<b>Unit 3</b>	<b>Contours of Constitutional Rights &amp; Duties:</b> Fundamental Rights Right to Equality Right to Freedom Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights Right to Constitutional Remedies Directive Principles of State Policy, Fundamental Duties.	(04)
<b>Unit 4</b>	<b>Organs of Governance:</b> Parliament, Composition, Qualifications and Disqualifications Powers and Functions Executive, President, Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	(04)



**Unit 5 Local Administration:**

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.  
 Pachayati raj: Introduction, PRI: Zila Pachayat.  
 Elected officials and their roles, CEO Zila Pachayat: Position and role.  
 Block level: Organizational Hierarchy (Different departments),  
 Village level: Role of Elected and Appointed officials,  
 Importance of grass root democracy. (04)

**Unit 6 Election Commission:**

Election Commission: Role and Functioning.  
 Chief Election Commissioner and Election Commissioners.  
 State Election Commission: Role and Functioning.  
 Institute and Bodies for the welfare of SC/ST/OBC and women (04)

**Text Books:**

- 1 "The Constitution of India", Government Publication, 1950 (Bare Act).
- 2 Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1<sup>st</sup> Edition, 2015.

**References:**

- 1 M. P. Jain, "Indian Constitution Law", 7<sup>th</sup> Edition, Lexis Nexis, 2014.
- 2 D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

**Useful Links:**

- 1 <https://nptel.ac.in/courses/103107084/Script.pdf>
- 2 <https://nptel.ac.in/syllabus/109103022/> IIT Guwahati

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	-	-	-	1	1	-	3	1	-	1
CO2	-	-	-	-	-	1	1	-	3	1	-	1
CO3	-	-	-	-	-	1	1	-	3	2	-	1
CO4	-	-	-	-	-	1	1	-	3	2	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**

**AU2229: Audit Course – II: Pedagogy Studies**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	2 Hrs/week	<b>MSE</b>	-
<b>Tutorial</b>	--	<b>ISE</b>	-
<b>Total</b>	Audit	<b>ESE</b>	-
<b>Credits</b>			

**Duration of ESE:**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Appraise pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- 2 Illustrate the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners.
- 3 Interpret how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Introduction and Methodology:</b> Aims and rationale, Policy background, Conceptual framework and Terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions., Overview of methodology and Searching	(04)
<b>Unit 2</b>	<b>Thematic overview:</b> Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education	(02)
<b>Unit 3</b>	<b>Evidence on the effectiveness of pedagogical practices</b> Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy	(04)
<b>Unit 4</b>	<b>Theory of change:</b> Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies	(02)
<b>Unit 5</b>	<b>Professional development:</b> alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes	(04)
<b>Unit 6</b>	<b>Research gaps and future directions:</b> Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact	(02)

**Text Books:**

- 1 Ackers J, Hardman F, “Classroom interaction in Kenyan primary schools”, Compare, 31 (2): 245-261, 2001.
- 2 Agrawal M, “Curricular reform in schools: The importance of evaluation”, Journal of Curriculum Studies, 36 (3): 361-379, 2004.
- 3 Akyeampong K, “Teacher training in Ghana - does it count?” Multi-site teacher education research project (MUSTER) country report 1. London: DFID, 2003.

**References:**

- 1 Akyeampong K, Lussier K, Pryor J, Westbrook J (2013), “Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
- 2 Alexander RJ, “Culture and pedagogy: International comparisons in primary education”, Oxford and Boston: Blackwell.
- 3 Chavan M, “Read India: A mass scale, rapid, „learning to read“ campaign”.

**Useful Links:**

- 1 [www.pratham.org/images/resource%20working%20paper%202.pdf](http://www.pratham.org/images/resource%20working%20paper%202.pdf).

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	-		1	1	3	-	3	-	1	1
CO2	-	-	-		1	1	3	-	2	-	1	1
CO3	-	-	-		1	1	2	-	3	-	1	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**

**AU2239: Audit Course – II: Stress Management by Yoga**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	2 Hrs/week	<b>MSE</b>	-
<b>Tutorial</b>	--	<b>ISE</b>	-
<b>Total</b>	Audit	<b>ESE</b>	-
<b>Credits</b>			

**Duration of ESE:**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Develop healthy mind in a healthy body thus improving social health.
- 2 Improve efficiency.

**Course Contents**

	<b>Hours</b>
<b>Unit 1</b> Definitions of Eight parts of yog. ( Ashtanga )	(08)
<b>Unit 2</b> <b>Yam and Niyam:</b> Do`s and Don`ts in life. i) Ahinsa, satya, astheya ii) Shaucha, santosh, tapa	(04)
<b>Unit 3</b> <b>Yam and Niyam:</b> Do`s and Don`ts in life. i) bramhacharya and aparigraha ii) swadhyay, ishwarpranidhan	(04)
<b>Unit 4</b> <b>Asan and Pranayam:</b> Various yog poses and their benefits for mind & body	(04)
<b>Unit 5</b> <b>Asan and Pranayam:</b> Regularization of breathing techniques and its effects-Types of pranayam	(02)
<b>Unit 6</b> <b>Types of Pranayam</b>	(02)

**Text Books:**

- 1 “Yogic Asanas for Group Training-Part-I”, Janardan Swami Yogabhyasi Mandal, Nagpur.

**References:**

- 1 Swami Vivekananda, “Rajayoga or conquering the Internal Nature”, AdvaitaAshrama (Publication Department), Kolkata.
- 2

**Useful Links:**

- 1 <https://nptel.ac.in/courses/109105113/> IIT KHARAGPUR
- 2 <https://nptel.ac.in/courses/109106059/6> IIT MADRAS

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	-	-	-	1	2	-	3	-	-	-
CO2	-	-	-	-	-	2	1	-	3	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**

**AU2249: Audit Course – II: Personality Development through Life Enlightenment Skills**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	2 Hrs/week	<b>MSE</b>	-
<b>Tutorial</b>	--	<b>ISE</b>	-
<b>Total</b>	Audit	<b>ESE</b>	-
<b>Credits</b>			

**Duration of ESE:**

**Course Outcome (CO):** After completion of course, students will be able to:

- 1 Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- 2 Relate the person who has studied Geeta will lead the nation and mankind to peace and prosperity
- 3 Appraise the Neetishatakam will help in developing versatile personality of students.

**Course Contents**

		<b>Hours</b>
<b>Unit 1</b>	<b>Neetisatakam-Holistic development of personality:</b> <ul style="list-style-type: none"> <li>• Verses- 19,20,21,22 (wisdom)</li> <li>• Verses- 29,31,32 (pride &amp; heroism)</li> <li>• Verses- 26,28,63,65 (virtue)</li> </ul>	(04)
<b>Unit 2</b>	<b>Neetisatakam-Holistic development of personality:</b> <ul style="list-style-type: none"> <li>• Verses- 52,53,59 (don'ts)</li> <li>• Verses- 71,73,75,78 (do's)</li> </ul>	(04)
<b>Unit 3</b>	<b>Approach to day to day work and duties:</b> <ul style="list-style-type: none"> <li>• Shrimad Bhagwad Geeta :</li> <li>• Chapter 2-Verses 41, 47,48,</li> <li>• Chapter 3-Verses 13, 21, 27, 35,</li> </ul>	(04)
<b>Unit 4</b>	<b>Approach to day to day work and duties:</b> <ul style="list-style-type: none"> <li>• Shrimad Bhagwad Geeta :</li> <li>• Chapter 6-Verses 5,13,17,23, 35,</li> <li>• Chapter 18-Verses 45, 46, 48.</li> </ul>	(04)
<b>Unit 5</b>	<b>Statements of basic knowledge:</b> <ul style="list-style-type: none"> <li>• Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68</li> <li>• Chapter 12 -Verses 13, 14, 15, 16,17, 18</li> <li>• Personality of Role model.</li> </ul>	(04)
<b>Unit 6</b>	<b>Shrimad Bhagwad Geeta:</b> <ul style="list-style-type: none"> <li>• Chapter2-Verses 17, Chapter 3-Verses 36,37,42,</li> <li>• Chapter 4-Verses 18, 38,39</li> <li>• Chapter18 – Verses 37,38,63</li> </ul>	(04)

**Text Books:**

- 1 Swami Swarupananda , “Srimad Bhagavad Gita” , Advaita Ashram (Publication Department), Kolkata

**References:**

- 1 P.Gopinath, Bhartrihari’s Three Satakam (Niti-sringar-vairagya), Rashtriya Sanskrit Sansthanam, New Delhi.

**Useful Links:**

- 1 <https://www.scribd.com/document/352547910/Bhagvad-Geeta-for-Common-Man-pdf>

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	-	-	-	1	1	-	3	-	-	-
CO2	-	-	-	-	-	-	2	1	3	-	-	-
CO3	-	-	-	-	-	1	-	1	3	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**First Year (Sem-II) M. Tech. Computer Science & Engineering**

**CS2301: Dissertation Phase-I**

**Laboratory Scheme**

**Practical** 14 Hrs/week  
**Total** 7

**Credits**

**Examination Scheme**

**ISE** 100  
**ESE** 100

**Course Outcome(CO):** After completion of course, students will be able to:

- 1 Identify self-learning topics.
- 2 Explore the survey literature and contact resource persons for the selected topic of research.
- 3 Develop oral and written communication skills to present and defend their work in front of technically qualified audience.

**Course Contents**

The Project Work should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. It should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

**Syllabus Contents:**

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following:

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain

The student should complete the following:

- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Report and presentation

**Guidelines for Dissertation Phase – I:**

- As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.
- The dissertation may be carried out preferably in-house i.e. department's laboratories and centres OR in industry allotted through department's T & P coordinator.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include Springer/Science Direct. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.



- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
- Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, a record of continuous progress.
- Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the phase-I work.

**List of Submission:**

1. Dissertation report should be prepared using Latex.

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	-	2	-	2	3	2	-	2	2	1
CO2	-	-	3	2	-	1	2	-	-	1	2	-
CO3	-	-	-	2	-	1	2	3	-	2	-	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**Second Year (Sem-III) M. Tech. Computer Science & Engineering**

**CS2302: MOOCs / OPEN COURSE**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
<b>Lectures</b>	-	<b>MSE</b>	-
<b>Tutorials</b>	-	<b>ISE</b>	-
<b>Total Credits</b>	<b>3</b>	<b>ESE</b>	<b>100</b>

**Course Outcome(CO):** After completion of course, students will be able to:

- 1 Learn independently the modern tools and technology.
- 2 Develop skills for solving problems for research project.
- 3 Identify the self-learning topics.

**Course Contents**

Online courses available on digital platform like MOOCs/ NPTEL/ SWAYAM etc during the academic semester will be reviewed and listed by departmental faculty board before start of every semester. Suitable course for registered candidate will be recommended by Guide and Programme Head considering skill sets and knowledge required for dissertation work of the individual candidate (from the list). It shall have minimum 8-12 weeks duration, peer graded assignment and examination to award grade by online course offering agency. The report of course completed with copy of Grade Report shall be submitted to the examination section. In case online course is not available, departmental committee will specially design syllabus for course under self-learning mode and guide will conduct end semester examination to award the grade.

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	-	3	1	3	1	1	3	1	1	1
CO2	-	-	-	3	-	3	-	1	3	-	1	1
CO3	-	-	1	3	-	3	1	-	3	-	1	1

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**Government College of Engineering, Karad**  
**Second Year (Sem-III) M. Tech. Computer Science & Engineering**

**CS2401: Dissertation Phase-II**

**Laboratory Scheme**

**Practical** 32 Hrs/week

**Total** 16

**Credits**

**Examination Scheme**

**ISE** 100

**ESE** 200

**Course Outcome(CO):** After completion of course, students will be able to:

- 1 Demonstrate techno socio aspects for problem solutions
- 2 Test and validate designed system towards fault tolerance.
- 3 Produce research findings in terms of possible technical publications and IPRs.

**Course Contents**

It is a continuation of Project work started in semester III. Student has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution, results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

The dissertation phase II is based on a report prepared by the students on dissertation allotted to them.

It may be based on:

- Experimental verification / Proof of concept.
- Design, fabrication, testing of Communication System.
- The viva-voce examination will be based on the above report and work.

**Guidelines for Dissertation Phase – II:**

- During phase – II, student is expected to exert on detail design, development, verification and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
- Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress (Log Book).
- Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension of work.

**List of Submission:**

1. Dissertation report should be prepared using Latex.

**Mapping of COs and POs:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	3	3	-	-	-	-	3	1	3	1
CO2	-	-	2	3	-	-	-	-	3	1	1	-
CO3	-	-	-	-	3	2	1	1	3	1	-	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)