Two-Year Postgraduate Programme

Master of Technology

Computer Engineering

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

Faculty of Engineering & Technology
Master of Technology in Computer Engineering

1. Vision of the Department

To be a distinct hub of education that prepares skilled professionals in the field of Computer Science and Engineering.

2. Mission of the Department

M1 Enhance academic performance by adopting industry-oriented curriculum focusing on the thrust area of computer education through integrated learning in collaboration with prominent industries.

M2 Preparing students to face challenges of the real world through internships and project-based learning.

M3 Foster a research culture that results in a sound knowledge base, high-quality publications, new products and IPR.

M4 Inculcate ethical consciousness in students so that they can achieve success in their professional endeavours and can become responsible citizens.

3. Program Educational Objectives

The statements below indicate the career and professional achievements that the M.Tech. Computer Science engineering curriculum enables graduates to attain.

PEO 1	Apply computer science and engineering theories, principles, and skills to address societal challenges
PEO 2	Display a lifelong learning mindset and adapt to quick technological developments in the sector.
PEO 3	Exhibit professionalism, collaboration, leadership abilities, and awareness of contemporary demands.

4. Program Learning Outcomes

Program Learning outcomes are statements conveying the intent of a program of study.

PLO 1	**Engineering knowledge:**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PLO 2	**Problem analysis:**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
PLO 3	**Design/development of solutions:**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs

		with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
PLO 4	**Conduct investigations of complex problems:**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PLO 5	**Modern tool usage:**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PLO 6	**The engineer and society:**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PLO 7	**Environment and sustainability:**	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
PLO 8	**Ethics:**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PLO 9	**Individual and team work:**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PLO 10	**Communication:**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PLO 11	**Project management and finance:**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PLO 12	**Life-long learning:**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Program Specific Learning Outcomes

PSO 1	**Demand as per recent development**	An ability to analyse, design, verify, validate, code and maintain the solution of given problem to derive execution of software system

PSO 2	**Software skill**	An ability to understand, apply and work with one or more domain using knowledge of mathematical techniques and principles with relevant areas of computer science

6. Credit Framework

Semester wise Credit distribution of the programme	
Semester-1	17
Semester-2	18
Semester-3	17
Semester-4	16
Total Credits:	**68**

Category wise Credit distribution of the programme	
Category	**Credit**
Major Core	20
Minor Stream	12
Multidisciplinary	3
Ability Enhancement Course	0
Skill Enhancement Courses	0
Value added Courses	3
Summer Internship	0
Research Project/Dissertation	30
Total Credits:	**68**

7. Program Curriculum

Semester 1						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	203200101	Research Methodology & IPR	2	2	0	0
2	203202136	Mathematical Foundations of Computer Science	3	3	0	0
3	203202137	Advance Data Structure using Python	4	3	2	0
4	203202138	Advance Machine Learning	4	3	2	0
5		AUDIT-1 (Complsory Subjects :1)	AUDIT	2	0	0
6		Elective - 1 (Complsory Subjects :1)	4	3	2	0
		Total	**17**	**16**	**6**	**0**

Audit 1						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
	203200102	English for Research Paper Writing	AUDIT	2	0	0
	203200103	Disaster Management	AUDIT	2	0	0
	203200104	Sanskrit for Technical Knowledge	AUDIT	2	0	0
	203200105	Value Education	AUDIT	2	0	0
Elective 1						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
	203202139	High performance computing	4	3	2	0
	203202140	Data Science	4	3	2	0
	203202141	Advance Cloud Computing	4	3	2	0
Semester 2						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
7	203202142	Seminar & Mini Project	2	0	4	0
8	203202143	Advance Algorithm	4	3	2	0
9	203202144	Secure Software Design	4	3	2	0
10	203202145	Advance Image processing	4	3	2	0
11		AUDIT-2 (Complsory Subjects :1)	AUDIT	0	0	2
12		Elective - 2 (Complsory Subjects :1)	4	3	2	0
		Total	**18**	**12**	**12**	**2**
Audit 2						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
	203200151	Constitution of India	AUDIT	0	0	2
	203200152	Pedagogy Studies	AUDIT	0	0	2
	203200153	Stress Management by Yoga	AUDIT	0	0	2
	203200154	Personality Development through Life Enlightenment Skills	AUDIT	0	0	2

Elective 2						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
	203202146	IOT with ML	4	3	2	0
	203202147	Game Theory	4	3	2	0
	203202148	Deep Learning	4	3	2	0
Semester 3						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
13	203202200	Phase - I Dissertation1	10	0	20	0
14		Elective - 3 (Complsory Subjects :1)	4	3	2	0
15		Open Elective (Complsory Subjects :1)	3	3	0	0
		Total	**17**	**6**	**22**	**0**
Elective 3						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
	203202204	Advance Compiler Design	4	3	2	0
	203202205	Ubiquitous Computing	4	3	2	0
	203202206	Block chain Technology	4	3	2	0
Open Elective						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
	203200201	Business Analytic	3	3	0	0
	203200202	Industrial Safety	3	3	0	0
	203200203	Operation Research	3	3	0	0
	203200204	Cost Management of Engineering Projects	3	3	0	0
	203200205	Composite Materials	3	3	0	0
	203200206	Waste to Energy	3	3	0	0
Semester 4						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
16	203202202	Phase - II Dissertation	16	0	32	0
		Total	**16**	**0**	**32**	**0**

Detailed Syllabus

Semester 1 - 1

a. **Course Name:** Research Methodology & IPR

b. **Course Code:** 203200101

c. **Prerequisite:** Knowledge of Electronics and Communication Systems and Technologies. Basic Computer Skills. Fundamental Knowledge of Area of Interest in relevant discipline.

d. **Rationale:** The objective of the course is intended to develop research skills systematically. This will impart the ability to select appropriate research methodology, experimental design, follow professional ethics and academic integrity, and develop oral and written presentation skills.

e. **Course Learning Objectives:**

CLOBJ 1	Understand the Foundations of Research Methodology.
CLOBJ 2	Acquire practical skills in designing research studies, including formulating research questions and hypotheses.
CLOBJ 3	Distinguish between different types of intellectual property, such as patents, copyrights, trademarks, and trade secrets.
CLOBJ 4	Recognize and address ethical considerations in research, including the importance of informed consent and confidentiality.

f. **Course Learning Outcomes:**

CLO 1	Understand research problem formulation.
CLO 2	Analyze research-related information.
CLO 3	Follow research ethics.
CLO 4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow's world will be ruled by ideas, concepts, and creativity.
CLO 5	Understand that IPR plays a crucial role in the growth of individuals and nations, emphasizing the need to promote awareness of Intellectual Property Rights among students.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	0	0	2	20	20	0	60	0	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	Meaning of research problem, 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 instrumentation.	20%	5
2	Effective literature studies approach, analysis. Plagiarism, Research ethics.	15%	5
3	Effective technical writing, how to write a report, Paper Developing a Research Proposal, Format of research proposal, presentation and assessment by a review committee.	15%	5
4	Nature of Intellectual Property: Patents, Designs, Trademarks, and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grant of patents, Patenting under PCT.	20%	5
5	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	15%	5

6	New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	15%	5

i. Text Books and Reference Books:

1. "Intellectual Property Rights Under WTO" by T. Ramappa; S. Chand, 2008
2. "Research Methodology: An Introduction for Science & Engineering Students" by Stuart Melville and Wayne Goddard; Juta & Co Ltd
3. "Research Methodology: An Introduction" by Stuart Melville; Juta and Company Ltd, 2004
4. "Research Methodology: A Step-by-Step Guide for Beginners" by Ranjit Kumar; PEARSON; 3rd Edition.
5. "Resisting Intellectual Property" by Halbert; Taylor & Francis Ltd., 2007
6. "Industrial Design" by Mayall; McGraw Hill, 1992
7. "Product Design" by Niebel; McGraw Hill, 1974
8. "Introduction to Design" by Asimov; Prentice Hall, 1962
9. "Intellectual Property in New Technological Age" by Robert P. Merges, Peter S. Menell, and Mark A. Lemley; 2016

Semester 1 - 2

a. **Course Name:** Mathematical Foundation of Computer Science

b. **Course Code:** 203202136

c. **Prerequisite:** Fundamental of Mathematics

d. **Rationale:** To understand the mathematical fundamentals that are prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, and Machine learning. It develops the understanding of the mathematical and logical basis of many modern techniques in information technology like machine learning, programming language design, and concurrency.

e. **Course Learning Objectives:**

CLOBJ 1	Develop a comprehensive understanding of definite and improper integrals, including the application of integration techniques to find areas and volumes in both Cartesian and Polar coordinates.
CLOBJ 2	Utilize differential equations to model and solve practical scenarios, demonstrating proficiency in various solution techniques.
CLOBJ 3	Analyse the convergence and divergence of sequences and series, employing tests such as the Alternating Series Test and Ratio Test.
CLOBJ 4	Analyse matrix operations and determinants, exploring their properties and applications in solving systems of linear equations.
CLOBJ 5	Apply Fourier series for representing periodic functions, verifying Dirichlet's conditions.
CLOBJ 6	Solve optimization problems using multivariable calculus concepts, such as Lagrange's multiplier.

f. **Course Learning Outcomes:**

CLO 1	Know the basic knowledge of sampling and non-sampling errors, principal steps in sample surveys, limitations of sampling, etc.
CLO 2	Make use of the basics of the design of experiments such as randomization and blocking.
CLO 3	Measure the Ratio-to-Moving Average and Link Relative methods.
CLO 4	Know the concepts of the time reversal test, factor reversal test, and circular test.
CLO 5	Know the concept of Life Tables, their construction, and uses.
CLO 6	Know the 'conditions for the consistency' and criteria for the independence of data based on attributes.
CLO 7	Identify the components of a classical hypothesis test.
CLO 8	Use the statistical inferential methods based on small and large sampling tests.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**Sampling Theory:** Principle steps in a sample survey, Census versus sample survey, sampling, and Non-sampling errors. Types of sampling subjective, probability, and mixed sampling methods. Simple Random Sampling, Stratified random sampling, Systematic sampling, Advantages, and Disadvantages of the above methods of sampling.	19	8
2	**Analysis of Variance and Design of Experiments:** One way & Two way classifications. Introduction to statistics, population vs sample, collection of data, primary and secondary data, types of variables: dependent, independent, categorical, and continuous variables, data visualization, measures of central tendency, measures of dispersion (variance). Principles of experimentation in Designs, analysis of completely randomized design (CRD), Randomized block design (RBD), and Latin square design (LSD) including one missing.	17	7
3	**Time series:** Time series and its components with illustrations, additive, multiplicative, and mixed models. Determination of trend by least squares, moving average methods. Growth curves and their fitting with reference to modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend, and link relative methods.	17	7
4	**Curve Fitting & Attributes:** Principle of least squares and fitting of polynomials and exponential curves. Theory of attributes: Independence and association of attributes, consistency of data, measures of association and contingency, Yule's coefficient of colligation.	19	8

5	**Testing of Hypothesis, Large Sample Tests and Small Sample Tests:** Formulation and procedure testing of hypothesis, critical region, two types of errors, level of significance and power of the test. Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems. Student t-distribution (test for single mean, two means, and paired t-test), testing of equality of variances (F-test), χ^2 -test for goodness of fit, χ^2 -test for independence of attributes.	28	12

i. Text Book and Reference Book:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol.I & II, 8th Edition. The World Press, Kolkata. (TextBook)

2. Richard A. Johnson, Iswin Miller and John Freund, Miller & Freund's probability & statistics for engineers, 7/3, Pearson, 2008.

3. Probability and Statistics for Engineers, By Johnson, R. A., Miller, I., and Feund, J. E. Miller and Feund's — 2011

4. Fundamentals of Mathematical Statistics, by S.C. Gupta and V. K. Kapoor — Sultan Chand & Sons

5. Daroga Singh and Chowdhary: Theory and Analysis of Sample Survey Designs, Wiley Eastern.

6. Rao, C. Radhakrishna: Linear statistical inference and its applications, Wiley.

7. Kish, Leslie: Survey Sampling, John Wiley, and Sons.

8. Cochran, W.G.: Sampling Techniques, Wiley Eastern.

9. Des Raj: Sampling Theory, McGraw Hill.

Semester 1 - 3

a. **Course Name:** Advance Data Structure using Python

b. **Course Code:** 203202137

c. **Prerequisite:** Inclination to basic knowledge of data structure.

d. **Rationale:** A systematic treatment of advanced data structures using Python programming language, intended for computer science majors seeking advanced Python experience. Coding topics include large program software engineering design, multidimensional arrays, string processing, primitives, compound types, and allocation of instance and static data. Data structure concept topics include dynamic memory, inheritance, polymorphism, hierarchies, recursion, linked-lists, stacks, queues, trees, hash tables, and graphs. Algorithm concept topics include searching, big-O time complexity, and analysis of all major sorting techniques, top down splaying, AVL tree balancing, shortest path algorithms, minimum spanning trees, and maximum flow graphs.

e. **Course Learning Objectives:**

CLOBJ 1	Develop a comprehensive understanding of different types of data structures and understand the concept of hashing and overcome collisions using collision resolution techniques.
CLOBJ 2	Analyze the algorithms used for nonlinear data structures, which consist of AVL trees, Binary trees, Red Black trees, and splay trees.
CLOBJ 3	Learn different string matching algorithms such as Longest common subsequence, Huffman coding, Boyer's Moore algorithm for String matching.
CLOBJ 4	Learn the concept of randomized data structure algorithms consisting of skip lists.
CLOBJ 5	Learn different algorithms used for solving computational geometry problems.
CLOBJ 6	Analyze the impact of data structure choices on memory usage and efficiency.

f. **Course Learning Outcomes:**

CLO 1	Understand the implementation of symbol tables using hashing techniques.
CLO 2	Develop and analyze algorithms for red-black trees, b-trees, and splay trees.
CLO 3	Develop algorithms for text processing applications.
CLO 4	Identify suitable data structures and develop algorithms for computational geometry problems.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**Dictionaries and Hashing:** Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.	21%	9
2	**Skip Lists:** Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.	19%	8
3	**Trees:** Binary Tree, Binary Search Trees, AVL Trees, Red Black Trees, Splay Trees, 2-3 Trees, B- Trees. Distributed trees, - creation, insertion, deletion, rotation.	18%	7
4	**Text Processing:** String Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, inverted index-creation, compression, keyword search, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.	21%	9
5	**Computational Geometry:** One Dimensional Range Searching, Two Dimensional Range Searching, constructing a Priority Search Tree, searching a Priority Search Tree, Priority Spatial data-structure: Range Trees, Quad trees, k-D Trees, R trees- indexing, searching, dynamic update.	21%	9

i. Text Book and Reference Book:

1. *Data Structures and Algorithm Analysis* in C++ (TextBook) by Mark Allen Weiss.
2. *Algorithm Design* By M T Goodrich, Roberto Tamassia, John Wiley.

3. Suman Saha, and Shailendra Shukla. *Advanced Data Structures: Theory and Applications.* CRC Press, 2019.

j. Practical List

1. Develop programs for
   - **a.** Heap Sort
   - **b.** Merge Sort
   - **c.** Quick sort by taking a random element as pivot
   - **d.** Selection
2. Program to perform insertion, deletion, and search operations on the following:
   - **a.** Single Linked List
   - **b.** Doubly Linked List
   - **c.** Circular Linked List
3. Implement the functions of a dictionary using Hashing
4. Implement hash tables with linear probing and double hashing. Demonstration of inserting and deleting elements.
5. Skip list: Implementations and operations.
6. Develop a program to perform insertion, deletion, and search operations on the following Trees
   - **a.** Binary Search Tree
   - **b.** B-Trees
   - **c.** AVL Tree
   - **d.** Red Black Trees
7. Program to perform operations of Brute Force Pattern matching algorithms and Knuth Morris Pratt algorithms
8. Program to perform operations of Boyer Moore pattern matching algorithms
9. Write a program to perform LCS algorithms
10. Program to perform Huffman coding algorithm
11. Program to solve One Dimensional Range Searching
12. Implement the priority search tree.
13. Implementation of kd-tree and their searching techniques.
14. Implement priority search trees and perform range searching.

Semester 1 - 4

a. **Course Name:** Advanced Machine Learning

b. **Course Code:** 203202138

c. **Prerequisite:** Basic Machine Learning Knowledge

d. **Rationale:** This course will introduce key concepts in pattern recognition and machine learning; including specific algorithms for classification, regression, clustering, and probabilistic modelling.

e. **Course Learning Objectives:**

CLOBJ 1	Develop a deep understanding of advanced machine learning algorithms.
CLOBJ 2	Learn techniques for optimizing and fine-tuning machine learning models.
CLOBJ 3	Understand and implement advanced neural network architectures.
CLOBJ 4	Gain expertise in transfer learning and domain adaptation techniques.
CLOBJ 5	Understand ethical considerations in machine learning and strategies to mitigate bias.
CLOBJ 6	Apply advanced machine learning techniques to real-world applications and case studies.

f. **Course Learning Outcomes:**

CLO 1	Distinguish between different graphical models.
CLO 2	Suggest apt inference for different graphical models.
CLO 3	Design high-dimensional objects.
CLO 4	Design systems that use the appropriate graph models of machine learning.
CLO 5	Modify existing machine learning algorithms based on Uncertainty Estimation.
CLO 6	Apply the concept of advanced machine learning for real-time applications.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	0	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**UNIT-1:** Fundamental concepts: Introduction to Data Science, Theory and Practices in Machine Learning, Designing a Learning System, Issues in Machine Learning, Applications of ML, Global Developments of ML, Key Challenges to Adoption of ML in India. Statistical Learning Techniques: Descriptive Statistics, Simple Linear Regression, ANOVA, Logistic Regression, Multi-Linear Regression, Correlation, Moving Average, Random Number Generation, Histogram Smoothing, Sampling, Rank Percentile.	10%	6
2	**UNIT-2:** Neurons and Biological Motivation. Linear Threshold Units. Perceptron: Representational Limitation and Gradient Descent Training, Perceptron Learning Rule, Hebbian Learning Rule, Delta Learning Rule, Loss Functions (L1 Loss, L2 Loss, Cross-Entropy), Multilayer Networks and Backpropagation Learning Algorithm, Feed Forward, Activation Functions, Types of Neural Network Architecture, Bias-Variance Trade-Off. Regularization and Model/Feature Selection, Optimizers (Gradient Descent, Adagrad, RMSProp, Adam), Learning Rate.	20%	12
3	**UNIT-3:** Bayes Theorem, Maximum Likelihood and Least Squared Error Hypothesis, Maximum Likelihood Hypothesis for Predicting Probabilities, Bayesian Belief Network.	20%	3

4	**UNIT-4:** Supervised Learning: Classification, Decision Trees, Random Forest Classifier, Bayes Optimal Classifier, Naïve Bayes Classifier, Support Vector Machine, K-Nearest Neighbours, Ensemble Methods – Bagging and Boosting. Unsupervised Learning: Clustering, K-Means, K-Medoids, Hierarchical Clustering, Density-Based Clustering, Association Rules, Dimensionality Reduction - Principal Component Analysis. Evaluation: Cross-Validation, Measures of Performance for Classification (Accuracy, Confusion Matrix, Precision, Recall, F1 Score), Measures of Performance for Clustering (Homogeneity, Completeness, V-Measure).	25%	12
5	**UNIT-5:** Reinforcement Learning: Q Learning, Non-Deterministic Rewards and Actions.	5%	2
6	**UNIT-6:** Introduction to Deep Learning, Deep Neural Networks, Restricted Boltzmann Machines, Convolutional Neural Networks, Autoencoders, Deep Belief Networks, Recurrent Neural Networks, Transfer Learning.	20%	8

i. Reference Books:

1. Machine Learning (Textbook) by Tom Mitchell — McGraw-Hill Science

2. Introduction to Machine Learning by Ethem Alpaydin — MIT Press

3. Pattern Recognition and Machine Learning by Bishop, Christopher — Springer

4. Pattern Classification by Richard O. Duda, Peter E. Hart, David G. Stork

5. The Elements of Statistical Learning by Trevor Hastie, Robert Tibshirani, Jerome Friedman — Springer 2009

6. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", MIT Press, 1998

j. List of Practicals:

1. Perform the following using Python Pandas and Matplotlib library on a dataset:

- **i.** Deal with missing values in the data either by deleting records or using mean/median/mode imputation.
- **ii.** Detect if outliers exist and plot the data distribution using Box Plots, Scatter Plots, and Histograms of Matplotlib library.
- **iii.** Create and display the correlation matrix of all features of the data. Record and analyze observations.

2. For the given dataset (you may continue to use the same processed dataset from experiment 1 only for this experiment), perform the following using Python Pandas and scikit-learn library or by writing your own user-defined function:

- **i.** Perform data standardization and normalization.
- **ii.** Select the 10 best features of the data using different statistical scoring methods (Hint: Chi-Squared Statistical Test is a good scoring method).

iii. Split the data into training and testing sets in a ratio of 80:20.

3. Implement linear regression and calculate different evaluation measures (MAE, RMSE, etc.) for the same. Also implement gradient descent and observe the cost with linear regression using gradient descent. Do not use any Python library for linear regression (Hint: Linear Regression Formula is $Y = mX + b$ where Y is the target variable and X is the independent variable).

4. Create visual analysis for the given dataset using MATLAB.

5. Implement logistic regression and calculate different evaluation measures (F-measures, Confusion Matrix, etc.) for the same. Also implement gradient descent and observe the cost with logistic regression using gradient descent (Hint: Confusion Matrix and F-measures involve use of True Negatives, True Positives, False Negatives, and False Positives). Also implement Cross-Validation.

6. Implement K-Nearest Neighbors, Support Vector Machine (SVM), and Naïve Bayes Classifier with Python's scikit-learn on different datasets. Compare the classifiers based on their evaluation measures.

7. Use K-Means Clustering and Hierarchical Clustering algorithm for the following datasets.

8. Implement the following using TensorFlow:

Constants, Variables, Placeholders, and Operations.

Creating Graph and Executing Graph.

Perform the third practical using TensorFlow.

9. Implement the Multi-Layer Perceptron from scratch with at least 3 layers for a classification or regression problem of your choice. Implement Backpropagation and observe underfitting, overfitting, and regularization.

10. Implement a Convolutional Neural Network (CNN) using Keras library for a face classification problem. Create a dataset of faces of your 5 friends. Also, use data augmentation technique to increase the dataset.

11. Train a Reinforcement Learning Agent for the Multi-Armed Bandit Problem and visualize the results using Matplotlib or Seaborn libraries in Python. Consider at least 15 arms (n=15).

12. Implement a Deep Learning Algorithm/Method to predict stock prices based on past price variation.

Semester 1 – 5

a. Course Name: English for Research Paper Writing

b. Course Code: 203200102

c. Prerequisite: Basic Knowledge about sentence formation using different words in present, past tenses and future time. Also, basic knowledge on the use of suitable nouns, adjectives, verbs, prepositions, etc.

d. Rationale: To provide a better insight for the effective use of grammar knowledge especially in writing and to put their own thoughts into writing.

e. Course Learning Objectives:

CLOBJ 1	Understand how to improve your writing skills and level of readability
CLOBJ 2	Learn about what to write in each section
CLOBJ 3	Understand the skills needed when writing a Title
CLOBJ 4	Ensure the good quality of the paper at very first-time submission

f. Course Learning Outcomes:

CLO 1	Understand how to improve your writing skills and level of readability
CLO 2	Learn about what to write in each section
CLO 3	Understand the skills needed when writing a Title
CLO 4	Ensure the good quality of the paper at very first-time submission

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	-	-	AUDIT	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**Unit 1:** Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.	16%	5
2	**Unit 2:** Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts., Introduction	17%	5
3	**Unit 3:** Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	17%	5
4	**Unit 4:** Key skills are needed when writing a Title, 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	17%	5
5	**Unit 5:** Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.	16%	5
6	**Unit 6:** Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	16%	5

i. Reference Books:

1. Intellectual Property Rights Under WTO T. Ramappa; S. Chand, 2008
2. Research methodology: an introduction for science & engineering students Stuart Melville and Wayne Goddard; Juta & Co Ltd
3. Research Methodology: An Introduction Wayne Goddard, Stuart Melville; Juta and Company Ltd, 2004
4. Research Methodology : A Step by Step Guide for Beginners Ranjit Kumar; PEARSON; 3rd
5. Resisting Intellectual Property Halbert; Taylor & Francis Ltd., 2007
6. Industrial Design Mayall; McGraw Hill, 1992
7. Product Design Niebel; McGraw Hill, 1974
8. Introduction to Design Asimov; Prentice Hall, 1962
9. Intellectual Property in New Technological Age Robert P. Merges, Peter S. Menell, and Mark A. Lemley; 2016

Semester 1 – 6

a. Course Name: Disaster Management

b. Course Code: 203200103

c. Prerequisite: Basics related to the disaster.

d. Rationale: To prepare for a leadership role in disaster management or the humanitarian field with in depth knowledge of resilience and risk reduction.

e. Course Learning Objectives:

CLOBJ 1	Ensuring the availability of local emergency equipment and transportation
CLOBJ 2	Achieving quick recovery from disaster.
CLOBJ 3	Long-term planning for particular disaster to reduce its risk.
CLOBJ 4	Shifting exposure from vulnerable area into safe place.

f. Course Learning Outcomes:

CLO 1	To integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
CLO 2	To describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.
CLO 3	To manage the Public Health aspects of the disasters.
CLO 4	To formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	-	-	AUDIT	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**Unit 1: Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	17 %	5
2	**Unit 2: Repercussions Of Disasters And Hazards:** Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem, Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Manmade disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	17%	5
3	**Unit 3:Disaster Prone Areas In India:** Study Of Seismic Zones; 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.	17%	5
4	**Unit 4: Disaster Preparedness And Management Preparedness:** 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.	17%	5
5	**Unit 5:Risk Assessment Disaster Risk:** Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's, Participation In Risk Assessment. Strategies for Survival.	16%	5
6	**Unit 6: Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	16%	5

i. Reference Books:

1. Disaster Management in India: Perspect ives, issues and strategies

2. By R. Nishith, Singh AK — 'New Royal book Company.

3. Disaster Mitigation Experiences And Reflections

4. By Sahni, Pardeep Et.Al. (Eds.) — Prentice Hall Of India, New Delhi.

5. Disaster Administration And Management Text And Case Studies

6. By Goel S. L., — Deep & Deep Publication Pvt. Ltd., New Delhi.

Semester 1 – 7

a. **Course Name:** Sanskrit for Technical Knowledge

b. **Course Code:** 203200104

c. **Prerequisite:** Knowledge of an Basic Level of Sanskrit

d. **Rationale:**To learn Sanskrit to develop the logic in mathematics, science other subjects enhancing the memory power and also will help scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

e. **Course Learning Objectives:**

CLOBJ 1	To give a comprehensive knowledge about the scriptural, classical and technical literature in Sanskrit.
CLOBJ 2	To impart an in-depth knowledge of the different schools of literary criticism in Sanskrit.
CLOBJ 3	To enable the scholars to master the technical nuances of philosophical deliberations deliberations.
CLOBJ 4	To introduce avenues for recent research in technical literature
CLOBJ 5	To open up vistas of inter-disciplinary research for social welfare
CLOBJ 6	To equip the scholars to resolve the issues of social challenges on grounds of value oriented findings in Sanskrit literature

f. **Course Learning Outcomes:**

CLO 1	To understand the importance of value based living.
CLO 2	To gain deeper understanding about the purpose of their life.
CLO 3	To understand and start applying the essential steps to become good leaders.
CLO 4	To emerge as responsible citizens with clear conviction to practice values and ethics in life.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	-	-	AUDIT	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr.	**Topics**	**W**	**T**
1	**Unit 1:** Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	33 %	10
2	**Unit 2:** Order, Introduction of roots Technical information about, Sanskrit Literature.	33%	10
3	**Unit 3:** Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	34%	10

i. Reference Books:

1. Abhyaspustakam By Dr.Vishwas — Samskrita-Bharti Publication, New Delhi
2. Teach Yourself Sanskrit By Prathama Deeksha-Vempati Kutumbshastri — Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. India's Glorious Scientific Tradition By Suresh Soni — Ocean books (P) Ltd., New Delhi

Semester 1 – 8

a. Course Name: Value Education

b. Course Code: 203200105

c. Prerequisite: basic understanding of ethical principles and the ability to critically reflect on personal values and their impact on society.

d. Rationale: This course prepares the students to understand value of education and self- development, imbibe good values in students and Let the should know about the importance of character.

e. Course Learning Objectives:

CLOBJ 1	To teach and inculcate the importance of value based living.
CLOBJ 2	To give students a deeper understanding about the purpose of life.
CLOBJ 3	To teach and inculcate the essential qualities to become a good leader.
CLOBJ 4	To expose students to the compelling challenges in society and make them respond positively.

f. Course Learning Outcomes:

CLO 1	To understand the importance of value based living.
CLO 2	To gain deeper understanding about the purpose of their life.
CLO 3	To understand and start applying the essential steps to become good leaders.
CLO 4	To emerge as responsible citizens with clear conviction to practice values and ethics in life.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	-	-	AUDIT	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**Unit 1:** Values and self-development: Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments	20 %	6
2	**Unit 2:** Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature, Discipline.	27%	8
3	**Unit 3:** Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature	27%	8
4	**Unit 4:** Character and Competence Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	26%	8

i. Reference Books:

1. Values and Ethics for organizations Theory and practice
2. By Chakroborty, S.K. — Oxford University Press, New Delhi, Pub. Year 1999

Semester 1 - 9

a. Course Name: High Performance Computing

b. Course Code: 203202139

c. Prerequisite: Basic Knowledge of Parallel Computing

d. Rationale: This course focuses on computing techniques needed to obtain high performance on current computer architectures.

css Copy code

e. Course Learning Objectives:

CLOBJ 1	To get insight of Parallel Computing fundamentals and related concepts.
CLOBJ 2	To design Parallel Algorithm approaches.
CLOBJ 3	To program Message Passing Interface for parallel program implementation.
CLOBJ 4	To get the basic knowledge of GPGPU and related concepts.
CLOBJ 5	To study the Performance Measures parameters briefly.

f. Course Learning Outcomes:

CLO 1	To knowledge the overview and analyze the performance metrics of high-performance computing.
CLO 2	To comprehend the various High Performance Computing Paradigms and Job Management Systems.
CLO 3	To analyze the benchmarks of high-performance computing.
CLO 4	To demonstrate the various emerging trends of high-performance computing.
CLO 5	To apply high performance computing concepts in problem solving.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**Introduction to Parallel Processing:** Parallel computing, scope of parallel computing, Levels of Parallelism (instruction, transaction, task, thread, memory, and function), Models (SIMD, MIMD, SIMT, SPMD, Data Flow Models, Demand-driven Computation, etc.). Loosely Coupled and Tightly coupled, Multi-Core Architecture, accelerators, GPGPUs.	15	7
2	**Parallel Algorithms:** Introduction to parallel algorithms, parallel algorithm models, decomposition techniques, characteristics of tasks & interactions, mapping techniques for load balancing, methods for containing interaction overheads.	20	8
3	**Programming Using Message Passing Paradigm:** Principles, building blocks, MPI, Overlapping Communication and computation, collective Communication operations, Composite synchronization Constructs, Open MP Threading Building blocks; An Overview of Memory Allocators, Parallel programming Model, combining MPI and Open MP, Shared memory Programming.	20	8
4	**Parallel Programming Using GPGPU:** An Overview of GPGPU, DGX architecture, An Overview of GPGPU Programming, An Overview of GPGPU Memory Hierarchy Features, CUDA Programming.	20	8
5	**Performance Measures:** Speedup, efficiency and scalability. Abstract performance metrics (work, critical paths), Amdahl's Law, abstract vs. Real performance (granularity, scalability).	10	4
6	**HPC on AI/ML/DL Platform:** Dask, Pytorch, Keras, Tensorflow, Case Study: Super Computers.	15	7

i. Text Book and Reference Book:

1. Introduction to Parallel Computing, By Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar — Pearson Publication (Textbook)
2. Advanced Computer Architecture: Parallelism, Scalability, Programmability, By Kai Hwang, Naresh Jotwani — McGraw Hill, Second Edition, 2010

j. Practical List:

1. Using Divide and Conquer Strategies design a class for Concurrent Quick Sort using C++.
2. Program distributes computation efficiently across the cluster. The program should be able to work with any number of nodes and should yield the same results as the serial code.

3. Write a program on an unloaded cluster for several different numbers of nodes and record the time taken in each case. Draw a graph of execution time against the number of nodes.
4. Write a program to check task distribution using Gprof.
5. Use Intel V-Tune Performance Analyzer for Profiling.
6. Analyze the code using Nvidia-Profilers.
7. Write a program to perform load distribution on GPU using CUDA.

Semester 1 - 10

a. **Course Name:** Data Science

b. **Course Code:** 203202140

c. **Prerequisite:**

d. **Rationale:** Provide you with the knowledge and expertise to become a proficient data scientist. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science. Produce Python code to statistically analyze a dataset. Critically evaluate data visualizations based on their design and use for communicating stories from data.

e. **Course Learning Objectives:**

CLOBJ 1	To introduce core concepts and terminology in Data Science, along with the tools and processes involved.
CLOBJ 2	To explore various data sources, collection methods, and data management strategies.
CLOBJ 3	To provide foundational knowledge in data analysis, including basic statistics and machine learning algorithms.
CLOBJ 4	To teach students how to visualize data effectively, using various types of visual encodings and visualization tools.
CLOBJ 5	To familiarize students with current trends in data collection, analysis, and visualization techniques.
CLOBJ 6	To apply the concepts learned to real-world scenarios through hands-on projects and examples.

f. **Course Learning Outcomes:**

CLO 1	Understanding Core Concepts: Students will grasp the fundamental concepts, processes, and tools used in Data Science.
CLO 2	Data Collection and Management: Students will learn how to collect, manage, and store data from various sources, including APIs.
CLO 3	Basic Data Analysis: Students will be able to perform basic data analysis, including statistical analysis and implementation of machine learning algorithms like Linear Regression, SVM, and Naive Bayes.
CLO 4	Data Visualization Skills: Students will develop the ability to create effective data visualizations, understanding the principles of visual encoding and mapping variables.
CLO 5	Application of Techniques: Students will be able to apply modern data science techniques to visualize data and develop applications, using tools like Bokeh in Python.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			External Evaluation		Total
				MSE	CE	P	Theory	P	
3	0	2	4	20	20	20	60	30	150

SEE- Semester End Examination; **CIA-** Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.); **CE-** Continuous Evaluation

h. Course Content:

Sr. No.	Topic	Weightage	Teaching Hours
1	**Introduction to core concepts and technologies:** Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.	12%	6
2	**Data collection and management:** Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.	15%	7
3	**Data analysis: 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.	21%	10
4	**Data visualization:** Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.	22%	11
5	**Applications of Data Science:** Technologies for visualization, Bokeh (Python)	15%	7
6	**Recent trends in various data collection and analysis techniques:** Various visualization techniques, application development methods used in data science.	15%	7

i. Reference Books:

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

j. List of Practical:

1. Study of various Machine Learning Tools (Scikit, Weka, Matlab).
2. Implement Linear Regression.
3. Implement SVM and decision tree classification techniques.
4. Implement Naïve Bayes classification technique.
5. Implement any one clustering technique.
6. Implement a simple application using a Machine Learning Algorithm.
7. Implement basic CRUD operations in MongoDB.
8. Write a program to retrieve various types of documents from a students collection.
9. Study of the following data visualization library/tools: Bokeh, matplotlib, and D3.js.
10. Visualize data using any data visualization framework.

Semester 1 - 11

a. **Course Name:** Advance Cloud Computing

b. **Course Code:** 203202141

c. **Prerequisite:**Basics of cloud computing and distributed computing.

d. **Rationale:** This course provides a broad introduction to cloud computing and its applications. It emphasizes to provide skills and knowledge about operations and management in cloud technologies along with recent research trends and advance in cloud computing.

e. **Course Learning Objectives:**

CLOBJ 1	Understand the Foundations of Cloud Computing
CLOBJ 2	Identify and Differentiate Cloud Service and Deployment Models
CLOBJ 3	Master Cloud Resource Virtualization
CLOBJ 4	Explore Cloud Computing Applications and Paradigms
CLOBJ 5	Implement Effective Resource Management and Scheduling
CLOBJ 6	Develop Applications on Cloud Platforms

f. **Course Learning Outcomes:**

CLO 1	Explain the evolution, characteristics, and business impacts of cloud computing and identify various cloud architectures.
CLO 2	Differentiate between IaaS, PaaS, and SaaS models and compare cloud deployment models, including SLA management.
CLO 3	Understand and manage virtualization technologies, including hypervisors and virtual machines, and handle provisioning and migration.
CLO 4	Develop and manage cloud applications using different architectural styles and programming models like MapReduce.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Topics**	Weightage	**Teaching Hours**
1	**UNIT-I:Foundations of cloud:** Inception and need for cloud computing: Motivations from distributed computing predecessors -Evolution - Characteristics - Business Benefits – Challenges in cloud computing - Exploring the Cloud Computing Stack - Fundamental Cloud Architectures – Advanced Cloud Architectures -Specialized Cloud Architectures	10%	4
2	**UNIT-II:Service Delivery and Deployment Models** Service Models (XaaS): Infrastructure as a Service (IaaS) - Platform as a Service (PaaS) – Software as a Service(SaaS) - Deployment Models: Types of cloud - Public cloud - Private cloud – Hybrid cloud – Service level agreements - Types of SLA – Lifecycle of SLA- SLA Management	12%	5
3	**UNIT-III: Cloud Resource Virtualization:** Virtualization as Foundation of Cloud – Understanding Hypervisors – Understanding MachineImage and Instances - Managing Instances – Virtual Machine Provisioning and Service Migrations	12%	5
4	**UNIT-IV: Cloud Computing: Applications and Paradigms** Existing Cloud Applications and Opportunities for New Applications – Architectural Styles for Cloud Applications – Workflows: Coordination ofMultiple Activities – Coordination Based on a State Machine Model: TheZooKeeper – The MapReduce Programming Model – A Case Study: TheGrepTheWeb Application	12%	5

5	**UNIT-V: Resource Management and Scheduling in Cloud** Policies and Mechanisms for Resource Management – Stability of a TwoLevel Resource Allocation Architecture-Feedback Control Based on Dynamic Thresholds Coordination of Specialized Autonomic Performance Managers - A Utility-Based Model for Cloud-Based Web Services - Resource Bundling:Combinatorial Auctions for Cloud Resources – Scheduling Algorithms for Computing Clouds – Resource Management and Dynamic Application Scaling	12%	5
6	**UNIT-V: Cloud Platforms and Application Development** Comparing Amazon web services, Google App Engine, Microsoft Azure from the perspective of architecture (Compute, Storage Communication) services and cost models. Cloud application development using third party APIs, Working with EC2 API – Google App Engine API - Facebook API, Twitter API.	20%	8
7	**UNIT-V: Advances and Recent trends in Cloud Through Research Perspective** Advances and Recent trends in Cloud Through Research Perspective	22%	9

i. Text Books and Reference Books:

1. Cloud Computing Principles and Paradigms (TextBook) By Rajkumar Buyya , James Broberg, Andrzej Goscinski — Willey
2. Cloud Computing Bible By Barrie Sosinsky — Wiley India Pvt Ltd
3. The Internet of Things: Connecting Objects to the Web By Hakima Chaouchi — Wiley Publications

j. List of Practicals:

1. Configure a VM instance in your local machine and in cloud (by creating a cloud account). Allocate CPU, memory and storage space as per a specified requirement. Install Guest OS image in that instance, launch the same and confirm the successful installation of the OS by performing few OS commands.
2. Configure a Nested Virtual Machine (VM under another VM) in cloud and local machine. Install OS images and work with few OS commands.
3. Create a SSH tunnel between your server in local machine and remote clients in EC2 instances and test the connections with programs using X11 traffic.
4. Install the Hadoop framework and create an application using Map Reduce Programming Model.
5. Perform live QEMU-KVM VM migrations using NFS 3 hours.
6. Experiment cloud scheduling algorithms using Cloud Sim/ OPNET /Cloud-Analyst tool.

7. Experiment cloud load balancing algorithms using Cloud Sim/ OPNET/CloudAnalyst tool.
8. Monitor, visualize and analyze performance of resource utilization in cloud platforms using Grafana tool.
9. Configure a VLAN using cisco packet tracer and analyze traffic issues.
10. Build container images, launch the container instance in the cloud and run an application inside the container instance in cloud.
11. EC2 AWS – Instance Creation, Migration.
12. DaaS – Deployment of a basic web app and add additional Functionality (Javascripts based).
13. SaaS – Deployment of any SaaS application for a online Collaborative tool.

Semester 2 - 1

a. Course Name: Seminar & Mini Project

b. Course Code: 203202142

c. Prerequisite: Basics of Software Engineering and Computer Programming Concepts.

d. Rationale: To explore the breadth of research that is being performed within the college/institution. To explore an discipline that is outside of immediate research interest or area.

e. Course Learning Objectives:

CLOBJ 1	Gain a comprehensive understanding of the product development process.
CLOBJ 2	Plan and organize major project activities to effectively channel efforts towards product development.
CLOBJ 3	Design, build, and implement a real-time application using available platforms.
CLOBJ 4	To understand the importance of document design by compiling Technical Report on the Mini Project work carried out.

f. Course Learning Outcomes:

CLO 1	Understand, plan, and execute the mini project to achieve significant research outcomes.
CLO 2	Design a real-time application focusing on emerging technological areas, and prepare a high-quality technical report.
CLO 3	Demonstrate the relevance of technical ideas in current technological advancements.
CLO 4	Gain an understanding of the research publication and copyright process.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	0	4	2	0	0	50	0	50	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Topics**	**Weightage**	**Teaching Hours**
1	**Weeks 1-2:** Allotment of mini-project guide, topic and platform finalization, and project planning.	15%	8
2	**Weeks 3-4:** Weeks 3-4: Conduct a literature review, finalize the methodology and specifications, and complete Review 1 to confirm the topic and specifications.	20%	8
3	**Weeks 5-6:** Simulate the idea using appropriate software tools and finalize the hardware platform.	15%	8
4	**Weeks 7-8:** Implement the platform, understand the software flow, execute block-level design, and conduct Review 2 to assess project progress.	15%	8
5	**Weeks 9-10:** Write the mini-project report, and plan and execute publication or copyright processes.	15%	8
6	**Weeks 11-12:** Demonstrate the project work, complete the final review, and ensure submission and compliance with term work requirements.	20%	8

Semester 2 - 2

a. **Course Name:** Advance Algorithm

b. **Course Code:** 203202143

c. **Prerequisite:** Inclination to basic knowledge of algorithm.

d. **Rationale:** This course aims to teach students the principals involved in algorithm and their application in various areas. It will cover all types of approach which will be applied in real application.

e. **Course Learning Objectives:**

CLOBJ 1	Understand and apply advanced algorithmic paradigms, such as divide and conquer, dynamic programming, greedy algorithms, randomized algorithms, and approximation algorithms
CLOBJ 2	Analyse the time and space complexity of algorithms using mathematical tools like big-O notation.
CLOBJ 3	Learning the concept of Dynamic programming including matrix multiplication, accounting method
CLOBJ 4	Learning the concept of Graph Algorithms
CLOBJ 5	Learning the NP completeness problem
CLOBJ 6	Analyse the Approximation algorithms

f. **Course Learning Outcomes:**

CLO 1	Introduce students to the advanced methods of designing and analyzing algorithms.
CLO 2	Introduce students to the advanced methods of designing and analyzing algorithms.
CLO 3	To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
CLO 4	To introduce the students to recent developments in the area of algorithmicdesign.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Topics**	Weigh-tage	**Teaching Hours**
1	**UNIT-I: Introduction:** Role of algorithms in computing, Analysing algorithms, Designing Algorithms, Growth of Functions, Divide and Conquer- The maximum-subarray problem, Strassen's algorithms for matrix multiplication, The substitution method for solving recurrences, The recurrence-tree method for solving recurrence, The master method for solving recursions, Probabilistic analysis and random analysis	20%	6
2	**UNIT-II:Review of Data Structures** Elementary Data Structures, Hash Tables, Binary Search Trees, Red-Black Trees	20%	5
3	**UNIT-III: Dynamic Programming** Matrix-chain multiplication, Elements of dynamic programming, Longest common subsequence, Greedy Algorithms– Elements of the greedy strategy, Huffman codes, Amortized Analysis – Aggregate analysis, The accounting method, The potential method, Dynamic tables..	20%	5
4	**UNIT-IV: Graph Algorithms** Elementary Graph Algorithms, Minimal spanning trees, Single-Source Shortest Paths, Maximum Flow	20%	8
5	**UNIT-V: Computational Geometry** NP-Complete & Approximate Algorithms: Polynomial time, Polynomial- time verification, NP-completeness and reducibility, NP-complete & approximation problems - Clique problem, Vertex cover problem, form ula satisfiability, 3 CNF Satisfiability, The vertex-cover problem, The traveling salesman problem, The subset-sum problem	20%	4

i. Text Books and Reference Books:

1. Advanced Algorithms and Data Structures by Marcello La Rocca

j. List of Practicals:

1. Write a program to implement Breadth First search or Depth First Search using graph
2. Write a Program to implement Dijkstra's shortest path algorithm.
3. Write a program to implement Prim's or Kruskal to find minimum Distance in MST.
4. Write a program to implement Edmond's Blossom algorithm to compute augmenting path.
5. Write a program to implement Strassen's algorithm of Matrix Multiplication.
6. Write a program to implement anyone (LCS, Making Change Problem) dynamic program application.
7. Write a program to implement Floyd-Warshall algorithm.
8. Write a program to implement randomized algorithm.
9. Write a program to implement approximation algorithm.
10. Write a study practical on NP-Hard Problem.

Semester 2 - 3

a. Course Name: Secure Software Design

b. Course Code: 203202144

c. Prerequisite: Basic knowledge of Software Engineering, Security Fundamentals.

d. Rationale: This course focuses on the software development design which is secure. There are so many security concerns for the software development process.

e. Course Learning Objectives:

CLOBJ 1	To deliver the basic Secure Software Design fundamentals.
CLOBJ 2	To have insight in to Enterprise Application Development process.
CLOBJ 3	To learn Enterprise Systems Administration.
CLOBJ 4	To study defending applications.

f. Course Learning Outcomes:

CLO 1	Develop robust and secure software architectures.
CLO 2	Implement secure coding practices to mitigate vulnerabilities.
CLO 3	Evaluate and select appropriate security controls.
CLO 4	Conduct threat modelling and risk assessment for software systems.
CLO 5	Apply secure design principles in real-world scenarios and applications.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Topics**	Weigh-tage	**Teaching Hours**
1	**UNIT-I: Secure Software Design** Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software, security design concepts, and Perform security testing and quality assurance.	15%	8
2	**UNIT-II: Enterprise Application Development** Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.	25%	11
3	**UNIT-III: Enterprise Systems Administration** Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email)	15%	8
4	**UNIT-IV: Enterprise Network** Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.	15%	8
5	**UNIT-V: Defending Applications** Handle insecure exceptions and command/SQL injection, defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.	20%	9

6	**UNIT-VI: Case Study** Case study of DNS server, DHCP configuration and SQL injection attack.	10%	4

i. Text Books and Reference Books:

1. **Secure Software Design (Textbook)** By Theodor Richardson, Charles N Thies — Jones & Bartlett
2. **Enterprise Software Security** By Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley — Addison Wesley

j. List of Practicals:

1. Study Practical on the identification of software vulnerabilities.
2. Study practical on the identification of software security design concepts.
3. Study of enterprise level scope and rules.
4. Enterprise application development services by sensiple.
5. Study and Identification of DNS.
6. Installation of DHCP server on windows.
7. Solar winds Network Performance Monitor.
8. Paessler PRTG Network Monitor Tool.
9. SQL injection on web application.

Semester 2 - 4

a. **Course Name:** Advance Image Processing

b. **Course Code:** 203202145

c. **Prerequisite:** Basic knowledge of Image Processing

d. **Rationale:** This course focuses on the analysis and optimization techniques needed to obtain high end.

e. **Course Learning Objectives:**

CLOBJ 1	Develop proficiency in advanced image enhancement methods.
CLOBJ 2	Understand and apply techniques for image restoration and reconstruction.
CLOBJ 3	Master advanced techniques for feature extraction and representation in images.
CLOBJ 4	Acquire skills in image segmentation and object recognition.
CLOBJ 5	Explore techniques for multimodal image processing and fusion.

f. **Course Learning Outcomes:**

CLO 1	Apply Advanced Image Enhancement Techniques.
CLO 2	Implement Image Restoration Algorithms.
CLO 3	Perform Feature Extraction and Representation.
CLO 4	Perform Image Segmentation and Object Recognition
CLO 5	Integrate Multimodal Information through Image Fusion‘

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Topics**	Weightage	**Teaching Hours**
1	**UNIT-I:** Wavelet and Other Image Transforms: Preliminaries, Matrix-based Transforms, Correlation, Basis Functions in the Time-Frequency Plane, Basis Images, Fourier-Related Transforms, Walsh-Hadamard Transforms, Slant Transform, Haar Transform, Wavelet Transforms.	26%	11
2	**UNIT-II:** Image Segmentation: Fundamentals, Point, Line, and Edge Detection, Thresholding, Segmentation by Region Growing and by Region Splitting and Merging, Region Segmentation Using Clustering and Super pixels, Region Segmentation Using Graph Cuts, Segmentation Using Morphological Watersheds, The Use of Motion in Segmentation, Image Segmentation Using Snakes, Segmentation Using Level Sets.	26%	11
3	**UNIT-III:** Image Feature Extraction: Background, Boundary Preprocessing, Boundary Feature Descriptors, Region Feature Descriptors, Principal Components as Feature Descriptors, Whole-Image Features, Scale-Invariant Feature Transform (SIFT).	24%	10
4	**UNIT-IV:** Image Pattern Classification: Background, Patterns and Pattern Classes, Pattern Classification by Prototype Matching, Optimum (Bayes) Statistical Classifiers, Neural Networks and Deep Learning, Deep Convolutional Neural Networks, Some Additional Details of Implementation.	24%	10

i. Text Books and Reference Books:

1. Digital Image Processing (Textbook) By Rafael C. Gonzalez and Richard E. Woods — Pearson Education.
2. Feature Extraction and Image Processing By Mark Nixon and Alberto Aguado — Academic Press, Pub. Year 2008
3. The Image Processing Handbook By John C. Russ — CRC Press, Pub. Year 2007

j. List of Practicals:

1. To study and implement basic commands of MATLAB required for digital image processing techniques, and various image file formats.
2. To study the effect of down sampling and quantization techniques on the grayscale image.
3. Write MATLAB code to enhance the visual quality of the image using point processing techniques, namely a) Image negative, b) Logarithmic transformation, and c) Power law transformation and Gray level slicing technique.
4. Write MATLAB code to display the histogram of the image and enhance the visual quality of the image with the help of histogram equalization technique.
5. Write MATLAB code to perform the bit-plane slicing method on grayscale image.
6. Write MATLAB code to demonstrate that the convolution in spatial domain is equivalent to multiplication in the frequency domain.
7. Write MATLAB code to restore grayscale image from noisy image with the help of image restoration techniques.
8. Write MATLAB code to perform Min, Median & Max Filtering on grayscale image.
9. Write MATLAB code to blur the image using Ideal High pass, Butterworth High pass and Gaussian High pass filter.
10. To study and implement basic commands of MATLAB required for digital image processing techniques, and various image file formats.

Semester 2 - 5

a. **Course Name:** Constitution of India

b. **Course Code:** 203200151

c. **Prerequisite:** Basic understanding of Indian history, political science, and the structure of government.

d. **Rationale:** Outlining the role and rights of citizens as well as defining the structure and powers of the government and its organs. Creating a path for the future citizens to build a corruption-free society. Indicating the nature of future society that has to be built by the joint efforts of the state and the citizens.

e. **Course Learning Objectives:**

CLOBJ 1	Create an awareness about the Constitution of India, Fundamental Rights and Duties, Directive Principles.
CLOBJ 2	Learn the role of Prime Minister, President and the Council of Ministers and the State Legislature.
CLOBJ 3	Learn the divisions of executive, legislative and judiciary and so on.
CLOBJ 4	Know how a municipal office, panchayat office etc. works.
CLOBJ 5	Understand the importance and role of Election Commission Function.

f. **Course Learning Outcomes:**

CLO 1	To know the importance of Constitution and Government.
CLO 2	To become Good Citizens and know their fundamental rights, duties and principles.
CLO 3	To learn about the role of PM, President, Council of Ministers and Local Administration.
CLO 4	Understand the importance of Election Commission.
CLO 5	Will know about Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Status of States etc.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	2	0	2	60	40	-	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Unit 1: Introduction to Constitution:** Meaning and importance of the Constitution, salient features of Indian Constitution. Preamble of the Constitution. Fundamental rights- meaning and limitations. Directive principles of state policy and Fundamental duties -their enforcement and their relevance.	25%	7
2	**Unit 2: Union Government:** Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature- Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India – composition and powers and functions.	25%	6
3	**Unit 3: State and Local Governments:** State Executive- Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court. Local Government-Panchayat raj system with special reference to 73rd and Urban Local Self Govt. with special reference to 74th Amendment.	25%	7
4	**Unit 4: Election provisions, Emergency provisions, Amendment of the constitution:** Election Commission of India-composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution-meaning, procedure and limitations.	25%	6

i. Reference Books and Textbooks:

1. M.V.Pylee, *Introduction to the Constitution of India*, 4th Edition, Vikas Publication, 2005.
2. Durga Das Basu (DD Basu), *Introduction to the Constitution of India* (Student Edition), 19th edition, Prentice-Hall EEE, 2008.

3. Merunandan, *Multiple Choice Questions on Constitution of India*, 2nd Edition, Meraga Publication, 2007.

Semester 2 - 6

a. **Course Name:** Pedagogy Studies

b. **Course Code:** 203200152

c. **Prerequisite:** Clear and effective communication is crucial in research pedagogy. Instructors need to be able to explain complex concepts, guide students through the research process, and provide constructive feedback. Strong communication skills also facilitate collaboration and discussion in the research learning environment.

d. **Rationale:** Research pedagogy encourages students to think critically and analytically. Engaging in research requires evaluating information, making informed decisions, and developing a deeper understanding of subject matter.

e. **Course Learning Objectives:**

CLOBJ 1	Students will be able to design and articulate a research question or problem, select appropriate research methodologies, and develop a comprehensive research plan.
CLOBJ 2	Students will demonstrate advanced information literacy skills, including the ability to critically evaluate and synthesize information from various sources to support research objectives.
CLOBJ 3	Students will develop and apply critical thinking skills to analyze research findings, draw meaningful conclusions, and assess the implications of their research within the context of existing knowledge.
CLOBJ 4	Students will understand and adhere to ethical considerations in research, including responsible conduct, proper citation practices, and the ethical treatment of research subjects, ensuring the integrity of the research process.

f. **Course Learning Outcomes:**

CLO 1	Understand the concept, nature, characteristics of growth and development.
CLO 2	Oriented towards Basics of pedagogy and familiarized with the educational process.
CLO 3	Understand the concept of Assessment and learning.
CLO 4	Apply the methods and strategies of Knowledge Acquisition, Retention and Transformation in new and unfamiliar situations.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	0	0	2	-	60	40	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topic	Weightage	Teaching Hours
1	**Unit-1:** Introduction and Methodology Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education Conceptual framework, Research questions Overview of methodology and Searching	25%	4
2	**Unit-2:** Thematic overview Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries Curriculum, Teacher education.	13%	2
3	**Unit-3:** Evidence on the effectiveness of pedagogical practices 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? Theory of change, Strength and nature of the body of evidence for effective pedagogical practices Pedagogic theory and pedagogical approaches Teachers' attitudes and beliefs and Pedagogic strategies	25%	4
4	**Unit-4:** Professional development 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	25%	4
5	**Unit-5:** Research Gaps Research gaps and future directions, Research design, Contexts Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.	12%	2

i. Reference Books:

1. Argumentative Writing in a Second Language: Perspectives Research and Pedagogy by Alan R. Hirvela and Diane Belcher
2. Child Psychology and Pedagogy: The Sorbonne Lectures 1949-1952 by Maurice Merleau-Ponty translated by Talia Welsh
3. Research Methodology: An Introduction by Wayne Goddard, Stuart Melville; Juta and Company Ltd, 2004
4. Research Methodology: A Step by Step Guide for Beginners by Ranjit Kumar; PEARSON; 3rd
5. Class in the Composition Classroom: Pedagogy and the Working Class edited by Genesea M. Carter and William H. Thelin

Semester 2 - 7

a. Course Name: Stress Management by Yoga

b. Course Code: 203200153

c. Prerequisite: Knowledge of Sanskrit & different languages to learn from different holy books

d. Rationale: Students will be able to manage stress.

e. Course Learning Objectives:

CLOBJ 1	Comprehend the basic rules of stress management.
CLOBJ 2	Understand your stress-triggers and controlling them.
CLOBJ 3	Develop proactive reactions to stressful conditions.
CLOBJ 4	To achieve overall good health of body and mind.

f. Course Learning Outcomes:

CLO 1	Develop a healthy mind in a healthy body, thus improving social health and efficiency.
CLO 2	Develop body awareness. Learn how to use the body in a healthy way to perform well in sports and academics.
CLO 3	Achieve balance, flexibility, and stamina; strengthen muscles and connective tissues, enabling good posture.
CLO 4	Manage stress through breathing, awareness, meditation, and healthy movement. Build concentration, confidence, and a positive self-image.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	0	0	2	-	60	40	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topic	Weightage	Teaching Hours
1	**Unit 1** Definitions of Eight parts of yoga (Ashtanga)	33%	8
2	**Unit 2** Yam and Niyam. Dos and Don'ts in life. i) Ahimsa, Satya, Astheya, Brahmacharya, Aparigraha ii) Shaucha, Santosh, Tapa, Swadhyay, Ishwarpranidhan	34%	8
3	**Unit 3** Asana and Pranayama i) Various yoga poses and their benefits for mind & body ii) Regularization of breathing techniques and its effects - Types of pranayama	34%	8

i. Continuous Evaluation: It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

j. Reference Books:

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

2. Raja-Yoga: Or, Conquering the Internal Nature by Swami Vivekananda

Semester 2 - 8

a. Course Name: Personality Development through Life Enlightenment Skills

b. Course Code: 203200154

c. Prerequisite: willingness to engage in self-reflection and an openness to learning and applying personal growth strategies.

d. Rationale: The course provides details of personality development using the study of Srimad Bhagavad Gita.

e. Course Learning Objectives:

CLOBJ 1	To develop and improve qualities such as communication skills.
CLOBJ 2	To develop and improve confidence and emotional intelligence.
CLOBJ 3	To improve self-awareness and leadership abilities.
CLOBJ 4	To develop and improve interpersonal skills, and overall personal effectiveness.

f. Course Learning Outcomes:

CLO 1	Develop his personality and achieve the highest goal in life with study of Shrimad-Bhagavad-Geeta.
CLO 2	Lead the nation and mankind to peace and prosperity after studying Geeta.
CLO 3	Develop a versatile personality with the study of Neetishatakam.
CLO 4	To manage personal and professional problems separately.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	0	0	0	-	60	40	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topic	Weightage	Teaching Hours
1	**Unit 1** Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom) Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue) Verses- 52,53,59 (don'ts) Verses- 71,73,75,78 (dos)	33%	8
2	**Unit 2** Approach to day to day work and duties. Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	34%	8
3	**Unit 3** Statements of basic knowledge. Shrimad Bhagwad Geeta: Chapter 2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. Shrimad Bhagwad Geeta: Chapter 2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter 18 Verses 37,38,63	33%	8

i. Reference Books:

1. Srimad Bhagavad Gita By Swarupananda, Swami — Advaita Ashrama
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) By P.Gopinath, Rashtriya Sanskrit Sansthanam — Rashtria Sanskrit

Semester 2 - 9

a. **Course Name:** IoT with Machine Learning

b. **Course Code:** 203202146

c. **Prerequisite:** Basic knowledge of AI and Machine Learning

d. **Rationale:** This course focuses on IoT and how it can be implemented in various real-world scenarios. IoT is about connecting electronic devices to the internet, allowing remote control. Sensors are used to sense the environment and control devices based on those values. These parameters are analyzed using machine learning to take actions, such as starting or stopping sprinklers. The course aims to understand practical problems and provide smart solutions.

e. **Course Learning Objectives:**

CLOBJ 1	To provide an understanding of the Internet of Things (IoT) and its implementation in various real-world scenarios.
CLOBJ 2	To explore the integration of IoT with Machine Learning (ML) for solving practical problems.
CLOBJ 3	To study IoT network architecture, including sensors, actuators, and smart objects.
CLOBJ 4	To analyze and clean IoT data, using protocols like MQTT and CoAP for data communication.
CLOBJ 5	To apply IoT and ML in specific domains such as healthcare, smart cities, and environmental quality monitoring.
CLOBJ 6	To classify and prevent attacks on IoT systems using ML techniques.

f. **Course Learning Outcomes:**

CLO 1	Understanding IoT Concepts: Students will understand the meaning and application of IoT in real-world scenarios.
CLO 2	Data Handling: Students will learn to fetch, clean, and manage IoT data effectively.
CLO 3	Model Selection: Students will be able to select appropriate Machine Learning models for given IoT scenarios.
CLO 4	Prototyping and Implementation: Students will convert prototype models into working models that can be applied for social causes.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	0	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**Foundations of IoT:** Basics of IoT, IoT Network Architecture and Design, Sensors and Actuators, Connecting Smart Objects.	15%	6
2	**Exploratory Data Analysis for IoT Domains:** Collecting IoT data using various technologies, Edge/Fog/Cloud computing for IoT data, Cleaning data, using application layer protocols to fetch IoT data: MQTT, CoAP.	20%	9
3	**Amalgamation of IoT and ML in the Healthcare Domain:** Introduction, Background, Various research methodologies used in different aspects of the healthcare domain, Various models used in different domains of healthcare, Discussion on various results achieved in the healthcare domain, conclusion.	15%	6
4	**Application of Machine Learning and IoT for Smart Cities:** Introduction, Background, Various research methodologies used in different aspects of the smart city domain, Various models used in different domains of smart city, Discussion on various results achieved in the smart city domain, conclusion.	15%	6
5	**Predicting Air and Water Quality Using IoT and Machine Learning:** Introduction, Background, Various research methodologies used in different parameters of air and water quality, Various models used in the prediction of air and water quality aspects, Discussion on various results achieved, conclusion.	15%	6

6	**Classification of Attacks on IoT Scenarios Using ML:** Introduction, Background, Various research methodologies used for intrusion detection and prevention in IoT scenarios, Various models used for intrusion detection and prevention in IoT scenarios using ML, Discussion on various results achieved for intrusion detection and prevention in IoT scenarios using ML, conclusion.	20%	9

i. Reference Books:

1. A Practical Guidebook to Learn and Implement IoT using Machine Learning by Purnendu Shekhar Pandey — Perception Publications
2. Shalli Rani, R. Maheswar, G. R. Kanagachidambaresan, Sachin Ahuja, Deepali Gupta. Machine Learning Paradigm for Internet of Things Applications, Wiley Publications, 2022.

j. List of Practicals:

1. Home Automation with Power Management perspective.
2. Predicting Air Quality Contents Using IoT and Machine Learning.
3. Predictive Analysis of Water Quality Using IoT and Machine Learning.
4. Smart Farming Using IoT.
5. Multi Object Detection and Colour Identification.
6. Speed Alert System at Blind Turns and Speed Breaker Detection.
7. Emotion Detection with Image Processing and Pulse Rate Sensor and GSR Sensor.
8. Remotely Monitoring and Controlling Muffle Furnace Using IoT and Image Processing.
9. Remotely Monitoring and Controlling Tensile Testing Machine Using IoT and Image Processing.
10. Hand Gesture Mouse Movement.
11. Deployment of External CPU Cooling Hardware by Applying IoT Data and Machine Learning Analysis.
12. Classification of Attacks on Raspberry Pi.
13. Overheat Notification of Mobile Phone Battery Using IoT and Machine Learning Analysis.

Semester 2 - 10

a. **Course Name:** Game Theory

b. **Course Code:** 203202147

c. **Prerequisite:** Basic knowledge of mathematics and algorithms.

d. **Rationale:** This course introduces the fundamentals of game theory and mechanism design. Motivations are drawn from engineered/networked systems (including distributed control of communication networks, incentive-compatible resource allocation, multi-agent systems, pricing, and investment decisions on the Internet) and social models (including social and economic networks). The course emphasizes theoretical foundations, mathematical tools, modeling, and equilibrium notions in different environments.

e. **Course Learning Objectives:**

CLOBJ 1	To introduce the fundamentals of game theory and mechanism design.
CLOBJ 2	To explore strategic interactions in engineered/networked systems and social models.
CLOBJ 3	To provide a mathematical and theoretical foundation for modeling and analyzing strategic situations.
CLOBJ 4	To study different equilibrium notions and their application in various environments.
CLOBJ 5	To understand the implications of game theory in economic, network, and social scenarios.
CLOBJ 6	To apply game theoretic techniques to solve real-world problems, including resource allocation, multi-agent systems, and pricing strategies.

f. **Course Learning Outcomes:**

CLO 1	Identify Strategic Situations: Students will be able to identify strategic situations and represent them as games.
CLO 2	Solve Games: Students will learn to solve simple games using various game theoretic techniques.
CLO 3	Analyze Economic Situations: Students will be able to analyze economic and strategic situations using game theory.
CLO 4	Recommend Strategies: Students will be equipped to recommend and prescribe optimal strategies for different scenarios.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	0	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**Introduction to Game Theory:** Games and solutions. Game theory and mechanism design. Examples from networks. Strategic form games: Matrix and continuous games. Iterated strict dominance. Rationalizability. Nash Equilibrium; existence and uniqueness. Mixed and correlated.	21%	9
2	**Learning, Evolution, and Computation:** Myopic learning; fictitious play. Bayesian learning. Evolutionarily stable strategies. Computation of Nash equilibrium in matrix games.	14%	6
3	**Extensive Games with Perfect Information and Repeated Games:** Backward induction and sub-game perfect equilibrium. Applications in bargaining games. Nash bargaining solution. Infinitely/finitely repeated games. Trigger strategies. Folk theorems. Imperfect monitoring and perfect public equilibrium.	17%	7
4	**Games with Incomplete Information:** Mixed and behavioral strategies. Bayesian Nash equilibrium. Applications in auctions. Different auction formats. Revenue and efficiency properties of different auctions.	19%	8
5	**Mechanism Design:** Optimal auctions; revenue-equivalence theorem. Social choice viewpoint. Impossibility results. Revelation principle. Incentive compatibility. VCG mechanisms. Mechanisms in networking, decentralized mechanisms.	14%	6

6	**Network Effects and Games over Networks:** Positive and negative externalities. Utility-based resource allocation. Selfish routing. Wardrop and Nash equilibrium. Partially optimal routing. Network pricing. Competition and implications on network performance. Strategic network formation. Price of anarchy.	15%	6

i. Reference Books:

1. Martin Osborne, *An Introduction to Game Theory*, Oxford University Press, 2003.

2. Vijay Krishna, *Auction Theory*, Academic Press.

3. Prajit Dutta, *Strategies and Games*, MIT Press.

4. Allan MacKenzie, *Game Theory for Wireless Engineers*, Synthesis Lectures on Communications, 2006.

5. http://www.ece.stevens-tech.edu/ ccomanic/ee800c.html

j. List of Practicals:

1. Rewrite two-person zero-sum games as linear programming problems, and solve such games in simple cases.

2. Bunty and Dolly are playing a game, described as follows: There are two boxes having A and B number of chocolates respectively. Both can eat L ($L \geq 1$) chocolates from any one box or L chocolates from both the boxes in one move. They play the game alternatively and the last one to eat the chocolate will be the winner. As Bunty wants to impress Dolly, he wants to make Dolly the winner. You have to write a program to help Bunty in deciding who should play first. *Assume that both the players play optimally.*

3. Write a program to implement the Game of Nim. The program assumes that both players are playing optimally.

4. A game is played between two players and there are N piles of stones such that each pile has a certain number of stones. On his/her turn, a player selects a pile and can take any non-zero number of stones up to 3 (i.e., 1, 2, 3). The player who cannot move is considered to lose the game (i.e., the player who takes the last stone is the winner). Write a program to find which player wins the game if both players play optimally (they don't make any mistakes).

5. You are given a middle game situation of Tic Tac Toe. It is given that it is player "X's" turn and you need to provide the most optimal position for the turn. The situation is given as a 3 x 3 character matrix board. _ refers to an empty place, `'o'` refers to a place marked by player O, and `'x'` refers to a place marked by player X. Write a program to determine the most optimal move for player X. *Assume player O played first.*

6. Write a program to demonstrate the working of Alpha-Beta Pruning.

7. Problem statement: Consider a row of n coins with values $v_1, v_2, \ldots, v_n$, where n is even. We play a game against an opponent by alternating turns. In each turn, a player selects either the first or last coin from the row, removes it from the row permanently, and receives the value of the coin. Determine the maximum possible amount of money you can definitely win if you move first. Note: The opponent is as clever as you. For example:

   i. For coins 5, 3, 7, 10: The maximum value collected is 15 (10 + 5).

   ii. For coins 8, 15, 3, 7: The maximum value collected is 22 (7 + 15).

   Write a program to find the maximum value from a given sequence of coins.

8. Given N piles containing only White (W) and Black (B) boxes, two players A and B play a game. Player A may remove any number of boxes from the top of the pile if the topmost box is White, and Player B may remove any number of boxes from the top of the pile if the topmost box is Black. If there is a pile with a top box as W, player A must remove one or more boxes. Similarly, if there is a pile with a top box as B, player B must remove one or more boxes. They play alternately, with player A making the first move. Both players play optimally. Write a program to determine the winner of the game (who cannot make the last move).

9. Two players are playing a game with n stones where player 1 always plays first. The two players move in alternating turns and play optimally. In a single move, a player can remove either 1, 3, or 4 stones from the pile. If a player is unable to make a move, that player loses the game. Given the number of stones where n is less than or equal to 200, find and print the name of the winner.

10. Write a program to illustrate the Zobrist Hashing Algorithm.

Semester 2 - 11

a. **Course Name:** Deep Learning

b. **Course Code:** 203202148

c. **Prerequisite:** Basic knowledge of AI and Machine Learning

d. **Rationale:** This course provides the information about the building blocks used in Deep Learning-based solutions. It includes details about feedforward neural networks, convolutional neural networks, recurrent neural networks, and attention mechanisms. It also covers various optimization algorithms such as Gradient Descent, Adam, AdaGrad, and RMSprop which are used for training deep neural networks.

e. **Course Learning Objectives:**

CLOBJ 1	To make the students comfortable with tools and techniques required in handling large amounts of datasets.
CLOBJ 2	To provide an idea of using various deep learning methods in NLP, Neural Network etc.
CLOBJ 3	To gain the knowledge of several libraries and datasets publicly available to illustrate the application of these algorithms.

f. **Course Learning Outcomes:**

CLO 1	Able to understand the mathematics behind the functioning of artificial neural networks
CLO 2	Able to analyze the given dataset for designing a neural network-based solution
CLO 3	Able to carry out design and implementation of deep learning models for signal/image processing applications
CLO 4	Able to design and deploy simple TensorFlow-based deep learning solutions to classification problems

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**Introduction to Neural Networks:** Basics of artificial neural networks (ANN): Artificial neurons, Computational models of neurons, Structure of neural networks, Functional units of ANN for pattern recognition tasks.	10%	4
2	**Feedforward neural networks:** Pattern classification using perceptron, Multilayer feedforward neural networks (MLFFNNs), Backpropagation learning, Empirical risk minimization, Regularization, Autoencoders	10%	6
3	**Deep Neural Networks (DNNs):** Difficulty of training DNNs, Greedy layer wise training, Optimization for training DNNs, Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam), Second order methods for training, Regularization methods (dropout, drop connect, batch normalization)	15%	12
4	**Convolutional Neural Networks (CNNs):** Introduction to CNNs - convolution, pooling, Deep CNNs, Different deep CNN architectures - LeNet, AlexNet, VGG, PlacesNet, Training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing CNNs.	20%	12
5	**Recurrent Neural Networks (RNNs):** Sequence modeling using RNNs, Back propagation through time, Long Short Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture.	20%	8
6	**Generative Models:** Restrictive Boltzmann Machines (RBMs), Stacking RBMs, Belief nets, Learning sigmoid belief nets, Deep belief nets, Stochastic AE, VAE, GAN.	15%	8
7	**Applications:** Applications in vision, speech, and natural language processing	10%	6

i. Reference Books

1. Deep Learning by Goodfellow, Bengio, and Courville, MIT Press
2. Charu C. Aggarwal. Neural Networks and Deep Learning: A Textbook. Springer. 2019
3. Dive into Deep Learning by Joanne Quinn, Joanne McEachen, Michael Fullan, Mag Gardner, Max Drummy, SAGE publication

j. List of Practicals:

1. Implement a feedforward neural network and write the backpropagation code for training the network. We strongly recommend using numpy for all matrix/vector operations. You are not allowed to use any automatic differentiation packages. This network will be trained and tested using the Fashion-MNIST dataset. Specifically, given an input image (28 x 28 = 784 pixels) from the Fashion-MNIST dataset, the network will be trained to classify the image into 1 of 10 classes.
2. For the best model identified above, report the accuracy on the test set of Fashion-MNIST and plot the confusion matrix.
3. Implement the backpropagation algorithm with support for the following optimization functions: i. sgd ii. Momentum based gradient descent iii. Nesterov accelerated gradient descent iv. rmsprop v. adam vi. nadam
4. Build a small CNN model consisting of 5 convolution layers. Each convolution layer would be followed by a ReLU activation and a max pooling layer. After 5 such conv-relu-maxpool blocks of layers you should have one dense layer followed by the output layer containing 10 neurons (1 for each of the 10 classes). The input layer should be compatible with the images in the iNaturalist dataset. The code should be flexible such that the number of filters, size of filters, and activation function in each layer can be changed. You should also be able to change the number of neurons in the dense layer. i. What is the total number of computations done by your network? ii. What is the total number of parameters in your network?
5. You will now train your model using the iNaturalist dataset. The zip file contains a preprocessed dataset with images organized by folders and each folder name indicates the corresponding label. The images are in RGB format. You need to write code that loads the images from the folder, performs the following preprocessing steps: resize the image, normalize the pixel values, and one hot encode the labels. Next, implement the following two architectures on your dataset and report the performance: i. AlexNet ii. VGGNet
6. Implement a simple RNN using any deep learning framework of your choice. Train this RNN on a text dataset, and evaluate the model's ability to generate text sequences. Report on the quality of generated text and include metrics or examples to show the model's performance.

7. Build a Convolutional Neural Network (CNN) with at least three convolutional layers and two fully connected layers. Train the network on a custom dataset (e.g., CIFAR-10 or a similar dataset) and report the training and validation accuracy. Include code to visualize the learned filters and activations.

8. Implement and evaluate a Generative Adversarial Network (GAN). Use the GAN to generate new samples similar to a given dataset. Report on the quality of generated samples and include examples of generated images.

9. Implement a Transfer Learning model using a pre-trained model (e.g., ResNet, VGG) and fine-tune it on a custom dataset. Report the accuracy and loss of the fine-tuned model and compare it to the baseline performance of the pre-trained model.

10. Implement a Variational Autoencoder (VAE) for generating new samples from a latent space. Train the VAE on a dataset of your choice and visualize the latent space to show how different samples are encoded. Report the quality of the generated samples and any potential improvements.

Semester 3 - 1

a. Course Name: Phase - I Dissertation

b. Course Code: 203202200

c. Prerequisite: Basics of Software Engineering and Computer Programming Concepts.

d. Rationale: To assess student's ability to communicate his/her ideas and work.

e. Course Learning Objectives:

CLOBJ 1	To understand the —Product Development Process.
CLOBJ 2	To plan for various activities of the major project and channelize the work towards product development.
CLOBJ 3	To build, design and implement real time application using available platforms.
CLOBJ 4	To inculcate research culture in students for their technical growth.
CLOBJ 5	To display the knowledge and capability required for independent work.

f. Course Learning Outcomes:

CLO 1	Ability to synthesize knowledge and skills previously gained and applied to an in depth study and execution of new technical problem.
CLO 2	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
CLO 3	Ability to present the findings of their technical solution in a written report.
CLO 4	Presenting the work in International/ National conference or reputed journals.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	0	20	10	0	0	100	0	100	200

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Topics**	**Weightage**	**Teaching Hours**
1	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.	100%	20

Semester 3 - 2

a. **Course Name:** Advance Compiler Design

b. **Course Code:** 203202204

c. **Prerequisite:** Basic Knowledge of Compilers and Automate Theory

d. **Rationale:** This course focuses on the analysis and optimization techniques needed to obtain high performance on current computer architectures.

e. **Course Learning Objectives:**

CLOBJ 1	Discuss need of compiler in a programming language.
CLOBJ 2	Familiarize the students with a good formal foundation on lexical and syntactic analysis.
CLOBJ 3	Outline the various systematic storage and register allocation techniques.
CLOBJ 4	Describe the concepts to support advanced language features and extensions.
CLOBJ 5	To implement robust error detection and recovery mechanisms

f. **Course Learning Outcomes:**

CLO 1	Specify the lexical and syntactic structure of a programming language and implement a compiler to validate the structure of an input program.
CLO 2	Apply the principles of storage allocation and register allocation to the generation of assembly code for an input program.
CLO 3	Compare and contrast different intermediate representations.
CLO 4	Define and implement peephole and local optimizations.
CLO 5	Define and implement global data-flow analyses and optimizations.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**UNIT-1:Introduction:** Front-end concepts: lexical, syntactic, and semantic analysis; intermediate representations.	15%	4
2	**UNIT-2:Optimization** Introduction to code optimization, efficient code generation and parallelizing compilers, Using Program Analysis for Optimization, peephole, local, global, and interprocedural optimizations.	20%	9
3	**UNIT-3:Data-flow analysis:** Classical theory, bi-directional flows, unified algorithms, Introduction to Abstract Interpretation, Control-Flow Optimizations. .	15%	5
4	**UNIT-4:Efficient code generation:** Algorithms, register allocation heuristics and automated tools. Parallelism detection: Data dependence, control dependence, various restructuring transformations on loops Inter-procedural analysis: Constant propagation, data dependence etc. Selected case studies.	25%	12
5	**UNIT-5: Virtual Machines and their Interpreters** Enable students to use vocabulary and useful expression to describe the picture. In this class the students will be trained to form logical connections between a set of pictures which will be shared with them. This geared towards building creativity and presentation skills.	25%	12

***Continuous Evaluation:**It consists of Assignments/Seminars/Presentations/Quizzes/ Surprise Tests (Summative/MCQ) etc.

i. Text Books:

1. Advanced Compiler Design and Implementation By S. Muchnick, Morgan Kaufmann Publication (TextBook)

2. High Performance Compilers for Parallel Computing By M. J. Wolfe, Addison-Wesley Publication

3. Compilers: Principles, Techniques, and Tools, 2nd Edition By Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, Addison-Wesley Publication

j. List of Practicals:

1. Write a C Program to Scan and Count the number of characters, words, and lines in a file.
2. Write a C Program to implement NFAs that recognize identifiers, constants, and operators of the mini language.
3. Implement the lexical analyser using JLex, flex or other lexical analyser generating tools.
4. Design Predictive Parser for the given language.
5. Design a LALR bottom up parser for the given language.
6. Write a Lex program to find out total number of vowels, and consonants from the given input string.
7. Implementation of Recursive Descent Parser.
8. Implementation of SLR Parser.
9. Convert the BNF rules into Yacc form and write code to generate abstract syntax tree.
10. A program to generate machine code from the abstract syntax tree generated by the parser.

Semester 3 - 3

a. Course Name: : Ubiquitous computing

b. Course Code: 203202205

c. Prerequisite: : Basic Knowledge of Networking, Wireless communication, Mobile Application.

d. Course Learning Objectives:

CLOBJ 1	Demonstrate an appreciation of the growing significance of ubiquitous or pervasive computing and the concomitant technological and social issues
CLOBJ 2	Demonstrate knowledge of current issues in ubiquitous computing, and show ability to research an area in depth.
CLOBJ 3	Select and justify appropriate technologies, development lifecycles and standards for mobile and pervasive applications.
CLOBJ 4	Be cognisant of the major mobile computing standards currently in use, their purpose and scope and their role in supporting access to platform and location independent applications.
CLOBJ 5	Communicate effectively in both written and oral work and in group situations.
CLOBJ 6	Effectively research current issues in this field in web-based and on-line environments.

e. Course Learning Outcomes:

CLO 1	Have knowledge about cellular networks, ad-hoc and sensor network protocols and standards.
CLO 2	Have knowledge about different mobile operating systems.
CLO 3	Introduce basic concepts of android programming.
CLO 4	Develop applications using android.
CLO 5	Introduce building mobile applications with android.

f. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

g. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**UNIT-1 Introduction & Networking Basics** Overview, Challenges, NFC, Wireless LAN	15%	6
2	**UNIT-2:Location in ubiquitous computing** Personal assistants, Location aware computing, Location tracking, Architecture, Location based service and applications, Location based social networks (LBSN), LBSN Recommendation.	15%	6
3	**UNIT-3:Context-aware computing** Context and Context-aware Computing, Issues and Challenges, Developing Contextaware Applications, System Architecture.	15%	6
4	**UNIT-4: Wearable computing** : Glass and Augmented Reality, EyeTracking, Digital Pen and Paper, Mobile social networking & crowd sensing, Event based social network	10%	6
5	**UNIT-5: Introduction to IoT & Data Analysis** Definition, trend, IOT components, IOT Applications, Cloud centric IOT, Open challenges, Architecture, Energy Efficiency, Participatory sensing, New Protocols, QoS, QoE,, OT and Data Management, Data cleaning and processing, Data storage models, Search techniques, Deep Web, Semantic sensor web, Semantic Web Data Management, Searching in IOT, Real-time and Big Data Analytics for The Internet of Things, Heterogeneous Data Processing, High-dimensional Data Processing, Parallel and Distributed Data Process.	20%	12

6	**UNIT-6:Introduction to Android & Android Application Design Essentials** History of Mobile Software Development, The Open Handset Alliance, The Android Platform, Android SDK, Building a sample Android, application, Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions, Managing Application resources in a hierarchy, Working with different types of resources.	25%	12

h. Text Books:

1. Ubiquitous Computing Fundamentals John Krumm, CRC Press, 2010 (Text-Book). Ubiquitous Computing by Stefan Poslad Wiley Publication.

i. List of Practicals:

1. Develop an android app which displays "Hello, welcome to Android Lab" message. Name of application should be set to "FirstApp".Application icon should be your own photograph. In your answer you should show appropriate files. Below each file, you should explain its contents in brief. This instruction is applicable to all tutorials. So it will not be repeated henceforth.

2. Develop an android app which displays a form to get following information from user. Username, Password, Email Address, Phone Number, Country, State, State, Gender, Interests, Birth Date , Birth Time Form should be followed by a Button with label "Submit". When user clicks the button, a message should be displayed to user describing the information entered. Utilize suitable UI controls (i.e. widgets). [When user enters country in AutoCompleteTextView, list of states should be displayed in Spinner automatically.]

3. Demonstration of different Menu layouts in Anroid.

4. Create a Context menu as follows: Put a TextView on Screen. When user presses TextView for long time, a context menu is displayed. Menu has following options: RED, GREEN and BLUE. When user selects a color, background color of TextView should be changed to selected color. Show all required files.

5. Develop an App to create a login Activity. It asks "username" and "password" from user. Create an Asyc task which communicates with server side services to check whether username and password are correct or not. Accordingly Activity displays appropriate message. On server side, create a web-page which to fetch data from database.

6. Develop a small project using Android and IoT both.

Semester 3 - 4

a. Course Name: Blockchain technology

b. Course Code: : 203202206

c. Prerequisite: Data Structure, Networking, OOP

d. Rationale: This course is intended to study the basics of Blockchain technology. During this course learners will explore various aspects of Blockchain technology like application in various domains. By implementing, learners will have ideas about private and public Blockchain, and smart contracts.

e. Course Learning Objectives:

CLOBJ 1	Understand how blockchain systems (mainly Bitcoin and Ethereum) work.
CLOBJ 2	To securely interact with them.
CLOBJ 3	Design, build, and deploy smart contracts and distributed applications.
CLOBJ 4	Integrate ideas from blockchain technology into their own projects.

f. Course Learning Outcomes:

CLO 1	Describe the basic concepts and techniques used for blockchain.
CLO 2	Describe the primitives of distributed computing and cryptography related to blockchain.
CLO 3	Illustrate the concepts of Bitcoin and their usage.
CLO 4	Implement the Ethereum blockchain contract.
CLO 5	Apply security features in blockchain technologies.
CLO 6	Use smart contracts in real-world applications.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	0	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**UNIT-1: Introduction of Cryptography and Blockchain** What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions And Blocks, P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain	10%	5
2	**UNIT-2: Bitcoin and Cryptocurrency** What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain And Digital Currency, Transactional Blocks, Impact Of Blockchain Technology On Cryptocurrency.	20%	7
3	**UNIT-3: Introduction to Ethereum** What is Ethereum, Introduction to Ethereum, Consensus Mechanisms, How Smart Contracts Work, Metamask Setup, Ethereum Accounts, Receiving Ether's What's a Transaction?, Smart Contracts.	15%	7
4	**UNIT-4: Introduction to Hyperledger** What is Hyperledger? Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer.	20%	9
5	**UNIT-5: Solidity Programming** Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types (Int, Real, String, Bytes, Arrays, Mapping, Enum, address)	20%	9
6	**UNIT-6: Blockchain Applications** Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.	15%	7

i. Text Books:

1. Blockchain Technology By Chandramouli Subramanian, Asha George, Abhilash K A and Meena Karthikeyan , Universities Press (TextBook)
2. Blockchain For Dummies By Tiana Laurence, Wiley Publication
3. Environmental Sciences By Daniel B Botkin & Edward A Keller — John Wiley & Sons.

4. Blockchain Blueprint for a New Economy By Melanie Swan, O'Reilly Publication

j. List of Practicals:

1. Create a Simple Blockchain in any suitable programming language.
2. Use Geth to Implement Private Ethereum BlockChain
3. Build Hyperledger Fabric Client Application.
4. Build Hyperledger Fabric with Smart Contract.
5. Create Case study of BlockChain being used in illegal activities in the real world.
6. Using Python Libraries to develop BlockChain Application.

Semester 3 - 5

a. **Course Name:** Business Analytics

b. **Course Code:** 203200201

c. **Prerequisite:** : Inclination to learn machine Learning, basic knowledge of differential classification clustering and regression algorithms , Data Mining.

d. **Rationale:** The course will provide a strong foundation on business analytics and the basic concepts.

e. **Course Learning Objectives:**

CLOBJ 1	To equip the students with basic understanding of business analytics and its role within an organization.
CLOBJ 2	To provide sound domain knowledge of business analytics and its critical concepts
CLOBJ 3	To prepare students for business intelligence systems and applications of business analyticsg.
CLOBJ 4	To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.

f. **Course Learning Outcomes:**

CO 1	Explain business analytics and its role within an organization.
CO 2	Acquire domain knowledge of business analytics and its critical concepts.
CO 3	Understand business intelligence systems and applications of business analytics.
CO 4	Formulate and solve business problems and to support managerial decision making.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**UNIT 1** Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.	15%	9
2	**UNIT 2** Trendiness and Regression Analysis: 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.	15%	8
3	**UNIT 3** Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.	20%	9

4	**UNIT 4** Forecasting Techniques: 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 20Model, Overbooking Model, Cash Buddget Model.	20%	10
5	**UNIT 5** Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	20%	10
6	**UNIT 6** Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	10%	4

i. Reference:

(a) "Fundamentals of Business Analytics" by R.N.Prasad and Seema Acharya" by William Stallings

(b) "Business Analytics – The Science of DataDriven Decision Making" by U. Dinesh Kumar

(c) ""Data Analytics " by Anil Maheshwari

(d) "Business Analytics for Managers: Taking Business Intelligence Beyond" by Jesper Thorlund & Gert H.N. Laursen

(e) "Business Analytics ", by Sahil Raj

Semester 3 - 6

a. Course Name: : Industrial Safety

b. Course Code: 203200202

c. Prerequisite: Requires Knowledge of basics of engineering.

d. Rationale: : The course will impart the Industrial safety, Maintenance Engineering, Fault Tracing.

e. Course Learning Objectives:

CLOBJ 1	Prevent incidents: Minimize the likelihood of accidents and injuries
CLOBJ 2	Ensure the well-being of industrial employees and protect machinery, materials and property
CLOBJ 3	To demonstrate knowledge of a safe working.
CLOBJ 4	To learn about various functions and activities of safety department.

f. Course Learning Outcomes:

CLO 1	Understand the industrial laws, regulations and source models.
CLO 2	Apply the methods of prevention of fire and explosions.
CLO 3	Accomplish standard safety procedures in an industrial environment.
CLO 4	Understand the methods of hazard identification and preventive measures.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	-	-	3	20	20	-	60	-	10

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**UNIT-1:Industrial safety** 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 color codes. Fire prevention and firefighting, equipment and methods.	18%	8
2	**UNIT-2: Fundamentals of maintenance engineering** 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 & its relation with replacement economy, Service life of equipment	18%	8
3	**UNIT-3: Wear and Corrosion and their prevention** Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.	20%	9
4	**UNIT-4: Fault tracing** 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, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.	22%	9

5	**UNIT-5: Periodic and preventive maintenance** 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. 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	22%	11

i. Text Books:

1. Maintenance Engineering Handbook By Higgins & Morrow — Da Information Services.
2. Maintenance Engineering By H.P.Garg — S. Chand and Company
3. Pump-hydraulic Compressors By Audels — Mcgrew Hill Publication.
4. Foundation Engineering Handbook By Winterkorn, Hans — Chapman & Hall London.

Semester 3 - 7

a. **Course Name:** Operation Research

b. **Course Code:** 203200203

c. **Prerequisite:** Basics Probability and Applied Mathematics.

d. **Rationale:** Increased productivity is a significant benefit of operation research that attracts numerous firms. The mathematical formulae employed in operations management research provide a number of optimal alternatives for factory size, inventory mix, labour planning, and incorporating new technology, among other things.

e. **Course Learning Objectives:**

CLOBJ 1	To develop formulation skills in transportation models and finding solutions
CLOBJ 2	To understand the basics in the field of game theory and assignment problems.
CLOBJ 3	To know how project management techniques help in planning and scheduling a project
CLOBJ 4	To enable the student to understand and analyse managerial and engineering problems.

f. **Course Learning Outcomes:**

CLO 1	To apply the dynamic programming to solve problems of discreet and continuous variables.
CLO 2	To apply the concept of non-linear programming
CLO 3	To carry out sensitivity analysis
CLO 4	To model the real world problem and simulate it.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**UNIT-1:** Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models	18%	8
2	**UNIT-2:** Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming	20%	8
3	**UNIT-3:** Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT	22%	8
4	**UNIT-4:** Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.	20%	9
5	**UNIT-5:** Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation	20%	10

i. Reference Books:

1. Operations Research By Hamdy Taha — Pearson
2. Principles of Operations Research: By Harvey M Wagner — Prentice Hall of India, Pub. Year 2010
3. Introduction to Optimisation: Operations Research By J.C. Pant, — Jain Brothers
4. Operations Research By Hitler Libermann — McGraw Hill, Pub. Year 2009
5. Operations Research: By Pannerselvam — Prentice Hall of India, Pub. Year 2010

Semester 3 - 8

a. Course Name: Cost Management of Engineering Projects

b. Course Code: 203200204

c. Prerequisite: Basic civil engineering knowledge.

d. Rationale: Project planning management and economics, cost concepts.

e. Course Learning Objectives:

CLOBJ 1	Ability to understand the basic concepts of Project planning, execution, and cost control
CLOBJ 2	Discuss about Various types of costs and its behaviour along with Quality Management
CLOBJ 3	Identify various types of Budgets involved in Cost Management process
CLOBJ 4	To arrive at accurate cost estimates and schedules, and to avoid cost over-runs and schedule slips

f. Course Learning Outcomes:

CLO 1	Understand principles of Strategic cost management
CLO 2	Understand principles of cost concepts.
CLO 3	Understand principles of cost behavior and Profit planning
CLO 4	Understand principles of quantitative techniques for cost management

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**UNIT-1:Introduction** Introduction and overview of stratigic cost management process	10%	4
2	**UNIT-2:Cost Concepts** Cost concepts in decision making; Relevant cost, Diffrential cost, Incremental Cost, Opportunity cost, Objectives of costing system; Inventory valuation, Creation of database for operational control, Provision of data for decision making.	18%	4
3	**UNIT-3:Project** Project: meaning,Different types, why to manage,cost overruns centers,various stages of project execution:conceptionocommissioning. Project execut on as conglomerat on of technicaland nontechnical activities. Detailed Engineering activit es.Pre project execution main clearances anddocuments Project team: Role of each member.Importance Project site: Data required withsigniftcance. Project contracts. Types and contents.Project execution Project cost control.Bar chartsand Network diagram. Project commissioning: mechanical and process	26%	13
4	**UNIT-A:Cost Behavior and Profit Planning** Cost Behavior and Profit Planning Marginal Costing: Distinction between MarginalCosting andAbsorption Costing; Break-even nalysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costi ng and Variance Analysis. Pricing strategies: Pareto Analysis. Targetcosting, Life Cycle Costing. Costing of service sector. Just-in-time approach,Material RequirementPlanning, Enterprise Resource Planning, TotalQuality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and ValueChainAnalysis.Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets. Measurement ofDivisional profitability pricing decisions including transfer pricing.	26%	13
5	**UNIT-5:Quantitative techniques** Quantitative techniques for cost management,Linear Programming, PERT/CPM,Transportation problems.Assignment problems, Simulation, Learning Curve Theorv.	20%	10

i. Text Books:

1. Cost accounting a managerial Emphasis By Prentice Hall of India
2. Advanced Management Accounting By Charles T Horngren and George Foster
3. Management and Cost Accounting Model Curriculum of Engineering and technology PG Courses[Vol II]

Semester 3 - 9

a. Course Name: Composite Materials

b. Course Code: 203200205

c. Prerequisite: Fundamental Knowledge of Solid Mechanics.

d. Rationale: Composite materials are extensively used in the aviation & automobile industries for the manufacturing of various parts. Composites are known to have a high strength to weight ratio and they, therefore, become the material of choice for aircraft manufacturing. There are several other benefits of using composite materials. This subject offers the knowledge and understanding of the engineering behaviour of composite materials, preliminary design concepts and their appropriate use.

e. Course Learning Objectives:

CLOBJ 1	Explain the behaviour of constituents in the composite materials.
CLOBJ 2	Enlighten the students in different types of reinforcement.
CLOBJ 3	understanding the different manufacturing methods available for composite material.
CLOBJ 4	Develop the student's skills of composite materials.

f. Course Learning Outcomes:

CLO 1	Explain the advantages and applications of composite materials.
CLO 2	Describe the properties of various reinforcements of composite materials.
CLO 3	Summarize the manufacture of metal matrix, ceramic matrix and C-C composites.
CLO 4	Describe the manufacture of polymer matrix composites.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	0	0	3	20	20	0	60	0	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**UNIT-I: Introduction** 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.	15%	7
2	**UNIT-II: Reinforcements** 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.	25%	10
3	**UNIT-III: Manufacturing of Metal Matrix Composites** 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..	20%	10
4	**UNIT-IV: Manufacturing of Polymer Matrix Composites** Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.	20%	10
5	**UNIT-V: Strength of Composites** Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failureinsight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.	20%	8

i. Text Books:

1. Introduction to composite materials design / 2nd ed.Ever J. Barbero.
2. Design and Analysis of Composite Structures: With Applications to Aerospace, By Christos Kassapoglou
3. Mechanics of composite structures / László P. Kollár, George S. Springer.
4. Composite materials : production, properties, testing and applications / K. Srinivasan.

Semester 3 - 10

a. Course Name: Waste to Energy

b. Course Code: 203200206

c. Prerequisite: Knowledge of Renewable Energy Sources.

d. Rationale: This course provides knowledge of utilization of the energy from waste and conversion of waste into Bio gas.

e. Course Learning Objectives:

CLOBJ 1	To enable students to understand of the concept of Waste to Energy.
CLOBJ 2	To link legal, technical and management principles for production of energy form waste.
CLOBJ 3	To learn about the best available technologies for waste to energy.
CLOBJ 4	To analyze of case studies for understanding success and failures.
CLOBJ 5	To facilitate the students in developing skills in the decision making process.

f. Course Learning Outcomes:

CLO 1	Make students aware about all the waste available and the ways to turn it into energy.
CLO 2	Utilize the bio mass energy in problem solving where conventional energy are not fruitful and require replacement.
CLO 3	MDescribe procedural approach for the biomass derived fuel system.
CLO 4	Apply the knowledge in planning and operations of Waste to Energy plants.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	0	0	3	20	20	0	60	0	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	**UNIT-I: Introduction to Energy from Waste** Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors	10%	4
2	**UNIT-II: Biomass Pyrolysis** Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.	15%	7
3	**UNIT-III: Biomass Gasification** 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.	20%	9
4	**UNIT-IV: Biomass Combustion s** 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.	20%	8
5	**UNIT-V: Biogas** 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 - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion – Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.	35%	17

i. Text Books:

1. Non Conventional Energy (TextBook) By Desai, Ashok V. — Wiley Eastern Ltd.
2. Biogas Technology - A Practical Hand Book By Khandelwal, K. C. and Mahdi, S. S. — Tata McGraw Hill Publishing Co. Ltd., Pub. Year 1983
3. Food, Feed and Fuel from Biomass (TextBook) By Challal, D. S. — IBH Publishing Co. Pvt. Ltd., Pub. Year 1991
4. Biomass Conversion and Technology (TextBook) By C. Y. WereKoBrobby and E. B. Hagan — John Wiley & Sons, Pub. Year 1996

Semester 4 - 1

a. Course Name: Phase - II Dissertation

b. Course Code: 203202202

c. Prerequisite: Should have ideas about the research and research methodology.

d. Rationale: The objective of the course is intended to develop the research skills in a systematic manner which will impart the ability to select appropriate research methodology, experimental design, follow professional ethics and academic integrity, and develop oral and written presentation skills.

e. Course Learning Objectives:

CLOBJ 1	To facilitate student to carry out extensive research and development project.
CLOBJ 2	Technical project at place of work through problem.
CLOBJ 3	A gap identification, development of methodology for problem solving, interpretation of findings.
CLOBJ 4	The presentation of results and discussion of findings in context of national and international research. .
CLOBJ 5	To display the knowledge and capability required for independent work.

f. Course Learning Outcomes:

CLO 1	Demonstrate advanced research skills by conducting a thorough literature review, identifying gaps in existing knowledge, and formulating relevant research questions in the field of Computer Science and Engineering.
CLO 2	Define and articulate complex problems within the chosen dissertation topic, applying critical thinking and analytical skills to break down the issues into manageable components, and proposing effective solutions or approaches.
CLO 3	Acquire an in-depth understanding of advanced theories, methodologies, and technologies relevant to the chosen dissertation topic. They will demonstrate the ability to apply this knowledge to solve real-world problems and contribute to the advancement of the field.
CLO 4	Develop strong written and oral communication skills, presenting their research findings, methodologies, and conclusions effectively to both technical and non-technical audiences. They will also demonstrate the ability to produce a comprehensive

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	0	32	16	0	0	100	0	100	200

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation; **CE-** Continuous Evaluation; **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	Weightage	Teaching Hours
1	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.	100%	32