Gurugram University Gurugram

Curriculum for UG Degree Course in

Computer Science and Engineering (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

5TH SEMESTER

B. Tech. (Computer Science and Engineering- Artificial Intelligence & Machine Learning)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - V

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**ESC**		Predictive Analytics	3	0	0	3	3	30	70		100
2.	**PCC**		Formal Languages & Automata	3	0	0	3	3	30	70		100
3.	**PCC**		Big Data Analytics	3	0	0	3	3	30	70		100
4.	**PCC**		Machine Learning and its Applications	3	0	0	3	3	30	70		100
5.	**PEC**		Professional Elective Course - I	3	0	0	3	3	30	70		100
6.	**OEC**		Open Elective Course - I	3	0	0	3	3	30	70		100
7.	**LC**		Predictive Analytics Lab	0	0	2	2	1	50		50	100
8.	**LC**		Big Data & Analytics Lab	0	0	2	2	1	50		50	100
9.	**LC**		Machine Learning Lab	0	0	2	2	1	50		50	100
10.	**HSMC***		Economics for Engineers	3	0	0	3	0	30	70		100*
11.	**PT**		Practical Training - I	0	0	2	2	1	50		50	100
			Total	**23**	**0**	**8**	**29**	**22**	**380**	**420**	**200**	**1000**

NOTE:

1. ***The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.**
2. **The evaluation of Practical Training – I will be based on the seminar, viva-voice, and report submitted by the students.**
3. **Choose any one from Professional Elective Course – I**
4. **Choose any one from Open Elective Course – I**

Professional Elective Course – I

1. Software Engineering
2. Web Technology
3. Digital Image Processing
4. Advance JAVA Programming
5. Distributed System

PREDICTIVE ANALYTICS

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Engineering Science Course				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To provide the knowledge of various quantitative and classification predictive models based on various regression and decision tree methods.
2. To provide the knowledge to select the appropriate method for predictive analysis
3. To provide the understanding of how to search, identify, gather and pre-process data for the analysis.
4. To provide the understanding of how to formulate predictive analytics questions.

UNIT - I

Introduction: The Analytics Life Cycle, Introduction to Predictive Analytics, Matrix Notation, Basic Foundations, Model, Method and Feature Selection

Regression: Covariance, Correlation and ANOVA review; Simple Linear Regression, OLS Model Diagnostics, Dummy Variables, Multivariate Regression, OLS Assumptions, Weighted Least Squares (WLS), Generalized Linear Models (GLM).

UNIT - II

Classification Models: Introduction, Binomial Logistic Regression, Multinomial Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis.

Decision Trees: Introduction Regression Trees, Regression Tree Issues, Classification Trees, Pruning Trees, Bootstrap Aggregation (Bagging), Random Forest Models.

UNIT - III

Data Pre-Processing: Overview, Variable Types, Introduction to Data Transformations, Data Transformations: Categorical to Dummy Variables, Polynomials, Box-Cox Transformation, Log & Elasticity Models, Logit Transformation, Count Data Models, Centering, Standardization, Rank Transformations, Lagging Data (Causal Models), Data Reduction.

UNIT - IV

Variable Selection: Dimensionality Issues, Multi-Collinearity, Variable Selection Methods, Step Methods.

Dimensionality: Regularization (Penalized or Shrinkage Models, Ridge Regression, LASSO, Dimension Reduction Models, Principal Components Regression (PCR), Partial Least Squares (PLS).

Machine Learning: Machine Learning Overview, Bias vs. Variance Trade-off, Error Measures, Cross-Validation.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Ability to develop and use various quantitative and classification predictive models based on various regression and decision tree methods.

CO2: Analyse the working mechanism of data pre-processing for the model building.

CO3: Ability to select the appropriate method for predictive analysis

CO4: Ability to search, identify, gather and pre-process data for the analysis.

CO5: Ability to formulate predictive analytics questions.

TEXT AND REFERENCE BOOKS:

1. "An Introduction to Statistical Learning: with Applications in R" by James, Witten, Hastie and Tibshirani, Springer, 1st. Edition, 2013.
2. "The Elements of Statistical Learning-Data Mining, Inference, and Prediction "by Trevor Hastie, Robert Tibshirani, Jerome Friedman , Second Edition , Springer Verlag, 2009.
3. Predictive & Advanced Analytics (IBM ICE Publication)

FORMAL LANGUAGES AND AUTOMATA THEORY

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Formal Languages and Automata Theory				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To understand basic concepts of formal languages and automata theory.
2. To study the types of Automata i.e., NFA, DFA, NFA with ϵ-transition and their interconversion methods and importance.
3. To Study formal languages of different kinds, such as regular and context-free languages. Understand the concept of grammar and its types. Removal of ambiguity and reduced form and Normal forms of grammar.
4. To develop the concepts and design of higher-level automata to accept the language not accepted by finite automata such as PDA &Turing machine.
5. To study the various properties of Turing machines and their design.

UNIT - I

Finite Automata: Introduction: Set, Power Set, Super Set, Alphabet, languages and grammars, productions and derivation, Deterministic finite automata (DFA), Non-Deterministic finite automata (NDFA), Equivalence of DFA and NDFA, Conversion of NFA to DFA, minimization of finite automata, Finite automata with ϵ- moves, Acceptability of a string by a finite Automata.
Introduction to Machines: Properties and limitations of Finite Automata, Mealy and Moore Machines, Equivalence of Mealy and Moore machines.

UNIT - II

Regular Expression: State and prove Arden's Method, Regular Expressions, Recursive definition of the regular expression, Regular expression conversion to Finite Automata, and vice versa.
Properties of regular languages: Regular language, pumping lemma for regular sets/languages, Application of regular languages.

UNIT - III

Grammars: Chomsky hierarchy of languages, Relation between different types of grammars, Context-free grammar, Derivation tree / Parse tree, Ambiguity in regular grammar and their removal,

Reduced Forms: Removal of useless symbols, null and unit productions, Normal Form: Chomsky Normal form (CNF) and Greibach Normal Form (GNF),

Push Down Automata: Introduction to PDA, Deterministic and Non-Deterministic PDA, Design of PDA: Transition table, Transition diagram and acceptability of strings by designed PDA, Pushdown automata (PDA) and equivalence with CFG.

UNIT - IV

Turing machines: The basic model for Turing machines I, Deterministic and Non- Deterministic Turing machines and their equivalence, Design of Turing Machines: Transition table, Transition diagram and acceptability of strings by a designed Turing machine. Variants of Turing machines, Halting problem of Turing machine, PCP Problem of Turing Machine, Linear Bounded Automata, TMs as enumerators.

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: define terminology related to the theory of computation.
CO2: explain the basic concepts and applications of Theory of Computation.
CO3: apply the principles of Theory of Computation to solve computational problems.
CO4: compare and contrast the hierarchy of grammars.
CO5: design various types of automata for given problems.
CO6: To solve various problems of applying normal form techniques, push-down automata, and Turing Machines.

TEXT AND REFERENCE BOOKS:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.
3. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.
4. Raymond Greenlaw, H. James Hoover, Fundamentals of the Theory of Computation, Principles and Practice, Morgan Kaufmann, 1998.
5. John C. Martin: Introduction to Languages and Automata Theory, 3rd edition, Tata McGraw-Hill, 2007

BIG DATA ANALYTICS

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Big Data Analytics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To describe the basic concepts of Big Data characteristics and Analytics.
2. To examine the Hadoop and MapReduce framework for processing large volume of data sets and various data analysis methods.
3. To store and retrieve the data effectively using MongoDB and report generation.
4. To analyze the big data for useful business applications and familiar with the Visualization.

UNIT – I

Introduction to Big Data: Types of Digital Data-Characteristics of Data, Evolution of Big Data, Definition of Big Data, Characteristics, Applications & Challenges with Big Data, 3Vs of Big Data, Non-Definitional traits of Big Data, Big Data workflow Management, Business Intelligence vs. Big Data, Distributed file systems.

UNIT – II

Big Data Analytics: Classification of analytics, Data Science, Terminologies in Big Data, CAP Theorem.

Introduction to Hadoop: Features, Advantages, Overview of Hadoop Eco systems, Hadoop distributions, SQL vs. Hadoop, Hadoop Components, Architecture, HDFS.

UNIT – III

Map Reduce: Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.

NoSQL: Types of Databases, Advantages, SQL vs. NoSQL, NewSQL

Mongo DB: Introduction, Features, Data types, Mongo DB Query language, CRUD operations, Arrays. Functions: Count, Sort, t – Limit, Skip, Aggregate, Map Reduce. Cursors: Indexes, Mongo Import, Mongo Export.

UNIT – IV

Cassandra: Introduction, Features, CQLData types, CQLSH, Key spaces, CRUD operations, Collections, Counter, TTL, alter commands, Import and Export, Querying System tables.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Identify the characteristics and challenges of big data analytics.

CO2: Implement the Hadoop and MapReduce framework for processing massive volume of data.

CO3: Analyze data by utilizing various statistical and data mining approaches.

CO4: Implement CRUD operations effectively using MongoDB and Report generation using Jaspersoft studio.

CO5: Explore the usage of Hadoop and its integration tools to manage Big Data and use Visualization Techniques.

CO6: Adapt adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

TEXT AND REFERENCE BOOKS:

1. T. Erl , W.Khattak and P. Buhler., *Big Data Fundamentals, Concepts, Drivers & Techniques* (1e), The Prentice Hall Service Technology Series, 2016.
2. S. Acharya, *Big Data and Analytics*, Wiley India Pvt. Ltd., 2015
3. V. Prajapati, *Big Data Analytics with R and Hadoop*, Packt Publishing Ltd., 2013.
4. A. Holmes, *Hadoop in Practice*, (2e), Manning Publications, 2015
5. S. Ryza, *Advanced Analytics with Spark: Patterns for Learning from Data at Scale*, (2e), O'Reilly, 2017

MACHINE LEARNING AND ITS APPLICATIONS

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Machine Learning and its Applications				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Understand the machine learning techniques.
2. Gain knowledge of linear regression models, Random Forests
3. KNN classifier Gain knowledge on the basics of probabilistic approaches like Naïve Bayes, Bayes Theorem
4. Acquire knowledge of Support Vector machines, K-means clustering techniques
5. Introduce the working principle of Artificial Neural networks

UNIT - I

Machine Learning: Definition, History, Need, Features, Classification of Machine Learning: Supervised learning, Unsupervised learning, Reinforcement Learning, Machine Learning life cycle, Applications of Machine Learning, Parametric vs. non-parametric models. Learning theory-bias/variance tradeoff, Underfitting, Overfitting, Major differences between statistical modelling and machine learning, Steps in machine learning model development, Machine learning losses, when to stop tuning machine learning models, Train, validation, and test data Cross-validation, Grid Search.

UNIT - II

Dimensionality reduction: Definition, Row vector and Column vector, how to represent a dataset, how to represent a dataset as a Matrix, Data preprocessing in Machine Learning: Feature Normalization, Mean of a data matrix, Column Standardization, Co-variance of a Data Matrix, Principal Component Analysis for Dimensionality reduction.

UNIT - III

Supervised Learning: Definition, how it works. Types of Supervised learning algorithms k - Nearest Neighbours, Naïve Bayes, Decision Trees, Naive Bayes, Linear Regression, Logistic Regression, Support Vector Machines.

UNIT - IV

Unsupervised Learning: Clustering: K-means. Ensemble Methods: Boosting, Bagging, Random Forests.
Dimensionality reduction techniques: PCA, LDA, ICA, SVD
Evaluation: Performance measurement of models in terms of accuracy, confusion matrix, precision & recall, F1-score, receiver Operating Characteristic Curve (ROC) curve and AUC, Median absolute deviation (MAD), Distribution of errors

COURSE OUTCOMES:
At the end of this course, students will demonstrate the ability to

CO1: Acquire the knowledge of machine learning model evaluation methods/measurements.
CO2: Understand different types of machine learning techniques and their applications in the real world.
CO3: Apply various mathematical models for supervised machine learning models.
CO4: Apply and evaluate the unsupervised machine learning models through various clustering algorithms.
CO5: Evaluate various machine learning algorithms through statistical learning techniques.
CO6: Apply reinforcement learning algorithms to solve real-time complex problems with an understanding of the trade-offs involved.
CO7: Design the recommendation system using natural language processing and evaluate the machine learning models through ANN.

TEXT AND REFERENCE BOOKS:

1. E. Alpaydin, Introduction to Machine Learning, (3e), PHI Learning 2015.
2. S Marsland, Chapman and Hall, Machine Learning: An Algorithmic Perspective, (2e), CRC,2014.
3. M. Bishop, Pattern Recognition and Machine Learning, (2e), Springer, 2013.
4. T. Mitchell, Machine Learning, (1e), McGraw Hill Education, 2017.
5. L.E. Sucar, Probabilistic Graphical Models: Principles and Applications (Advances in Computer Vision and Pattern Recognition), (1e), Springer, 2016

ECONOMICS FOR ENGINEERS

Semester	V				
Course code					
Category	Humanities & Social Sciences, Including Management				
Course title	Economics for Engineers				
Scheme and Credits	L	T	P	Credits	
	3	0	0	0	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Understand how economic analysis can be applied to engineering decision-making processes.
2. Understand the implications of economic factors on engineering design, production, and operation decisions.
3. Apply economic principles to analyze and interpret the behavior of markets and industries.
4. Gain awareness of the relationship between economics and sustainable development in engineering practices.

UNIT - I

Definition of Economics- Various definitions, types of economics- Micro and Macro-Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, Elasticity of Demand- meaning, factors effecting it, its practical application and importance.

UNIT - II

Production- Meaning of Production and factors of production, Law of variable proportions, and returns to scale, Internal external economies and diseconomies of scale. Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Realcost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT - III

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT - IV

Indian Economy- Nature and characteristics of Indian economy as under developed, developing and mixed economy (brief and elementary introduction), Privatization - meaning, merits and demerits. Globalization of Indian economy - merits and demerits.
Banking- Concept of a Bank, Commercial Bank- functions, Central Bank- functions, Difference between Commercial & Central Bank.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: outline the principles of economics in general and economics in Indian context.
CO2: discuss concepts related to economics in general and particularly relevant to Indian scenario.
CO3: apply the principles of economics for solving problems related to Engineering sector.
CO4: carry out cost/benefit/, life cycle and breakeven analyses on one or more economic alternatives.
CO5: judge the issues and challenges of sustainable development.
CO6: Undertake problem identification, formulation and solution.

TEXT AND REFERENCE BOOKS:

1. Alfred William Stonier, D. C. Hague, A text book of Economic Theory, 5th edition, Longman Higher Education, 1980.
2. K. K. Dewett, M. H. Navalur, Modem Econornic Theory, S. Chand, 2006.
3. H. L. Ahuja, Modern Microeconomic: Theory and Applications, S. Chand, 2017.
4. N. Gregory Mankiw, Principles of Economics, 7th edition, South-Western College Publishing, 2013.
5. Ruddar Dutt & K. P. M. Sundhram, Indian Economy, S. Chand, 2004.
6. V. Mote, S. Paul, G. Gupta, Managerial, Economics, McGraw Hill Education, 2017.
7. Saroj Pareek, Text book of Business Economics, Neha Publishers and Distributors, 2013.
8. William McDonough and Michael Braungart, Cradle to Cradle Remaking the Way We Make Things, North Point Press, New York, 2002.
9. Sustainable Development Challenges, World Economic and Social Survey, United Nations Publication, 2013.

PREDICTIVE ANALYTICS LAB

Semester	V				
Course code					
Category	Laboratory course				
Course title	Predictive Analytics Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 5 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Introduction to Python libraries used for Predictive Analytics
2. Implement Simple Linear Regression Model using different datasets.
3. Implement Multiple Linear Regression Model using different datasets.
4. Execute Linear Discreminant Analysis (LDA) and show its characteristics.
5. Execute Principal component analysis (PCA) and show its characteristics.
6. Implement Ridge regression and show its effect on dataset.
7. Program to show Cross-validation and boot strap.
8. Program to execute fitting and classification.
9. Program to execute regression trees.
10. Program to execute K-nearest neighours,
11. Program to execute K-means clustering.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Show the execution and learning of Python libraries Environment.

CO2: Make use of simple and multiple regression models.

CO3: Understand the concept of Feature selection using LDA.

CO4: Understand the concept of Dimension Reduction using PCA.

CO5: Analyze the datasets using fitting and classification.

CO6: Applying KNN and K-means clustering for data analysis.

BIG DATA ANALYTICS LAB

Semester	V				
Course code					
Category	Laboratory course				
Course title	Big Data Analytics Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 5 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Installing and configuring Hadoop cluster.
2. Manipulating files in HDFS using Hadoop fs commands.
3. Hadoop File Systems: IBM GPFS, MapR-FS, Lustre, Amazon S3 etc.
4. Writing an Inverted Index MapReduce Application.
5. Distributed Cache MapReduce Design Patterns Sorting Joins.
6. Writing a streaming MapReduce job in Hadoop.
7. Big Data and R: Clustering, Simple Linear Regression, Decision Trees, Naïve Bayesian Classification**.**
8. Big Data Interactions: Big Data and Cloud: Big Data and Web Services /SOA:Big Data and Internet of Things (IoT)**.**
9. Big Data Case Study: Healthcare Data: Web Click stream Data: Social Media Data [RSS, Tweets]**.**

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: implement solutions for big data problem.

CO2: apply Hadoop ecosystem components.

CO3: analyse the results of big data algorithms.

CO4: build and maintain reliable, scalable, distributed systems.

CO5: create lab record of the lab assignments that contains problem definitions, their solutions in big data perspective and the interpretation of the results.

CO6: demonstrate ethical practices, self-learning and team spirit.

MACHINE LEARNING LAB

Semester	V				
Course code					
Category	Laboratory course				
Course title	Machine Learning and its Application Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 5 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Implement program to perform automatic word analysis.
2. Two assignments related to classification algorithms and interpreting the results of these algorithms**.**
3. Two assignments related to clustering algorithms and interpreting the results of these algorithms.
4. Three assignments on designing neural networks for solving learning problems.
5. Two assignments on ranking or selecting relevant features.
6. Two assignments on linear regression and logistic regression.
7. One assignment to be done in groups.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: implement machine learning algorithms using modern machine learning tools.

CO2: analyse the trends in datasets using descriptive statistics.

CO3: apply descriptive and predictive modelling.

CO4: compare and contrast machine learning algorithms for a given problem. (Describe datasets using descriptive statistics.

CO5: create lab records of assignment by incorporating problem definitions, design of solutions, results and interpretations.

CO6: demonstrate use of ethical practices, self-learning and team spirit.

PRACTICAL TRAINING - I

Semester	V				
Course code					
Category	Practical Training (PT)				
Course title	Practical Training - I				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

The evaluation of Practical Training - I will be based on the seminar, viva voice, and report submitted by the students.

Professional Elective Course - I

SOFTWARE ENGINEERING

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Software Engineering				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Be successful professionals in the field with solid fundamental knowledge of software engineering.
2. To enable students to apply a systematic application of scientific knowledge in creating and building cost-effective software solutions to business and other types of problems.
3. To make students understand different phases to make a software & study them in detail.
4. To make students understand different testing techniques for different projects, making the students understand to develop quality software, its maintenance & software reliability.
5. To make students aware about the design models & its principles (data design, component design, interface design & architectural design).

UNIT - I

Introduction:- Evolving role of software, Software Characteristics, Software crisis, Software myths, Software process, Software development Models: Waterfall Model, Prototype Model, Spiral, Model, RAD Model, Iterative Model, Incremental Model, Aspect-oriented Model, **Agile Methodology:** Pair and mob programming, high performance teams with core protocols, test driven development, behaviour driven development, continuous delivery, clean code, refactoring, extreme programming, Scrum.

UNIT - II

Requirements, Analysis & Specification:- Software Requirements engineering, Requirement Engineering Process, Requirement Engineering Tasks, Types of requirements, SRS.

System Modeling:- Data Modeling, Functional modeling and information flow: Data flow diagrams, Behavioral Modeling, The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the data dictionary.

UNIT - III

System Design:- Design principles, the design process; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion,

Coupling; Design Heuristics for effective modularity, Data Design, Architecture Design, Interface Design.

Software Testing And Maintenance:- Testing terminology: error, bug/defect/fault, failure, Verification and validation, Test case design, Static testing, Dynamic testing, Black box testing, Boundary value analysis, White box testing, basis path testing, Unit testing, Integration testing, Acceptance Testing, debugging, debugging process debugging approaches. Software maintenance categories, Models.

UNIT - IV

Software Quality Models And Standards:- Quality concepts, Software Quality Assurance, SQA activities, Formal approaches to SQA; Statistical software quality assurance; CMM, The ISO 9126 Standard, Configuration Management, Software reengineering, reverse engineering, restructuring, forward engineering,

Software Project Management:- Project management concepts, Planning the software project, Software Estimations, empirical estimation COCOMO, staffing, team structures, staffing, risk analysis and management.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand basic concepts of software engineering, implement Software life cycle models and have knowledge of different estimation models.
CO2: Understand requirements and modelling concepts in software development.
CO3: Understand the different design principles of a software project and prepare soft testing strategies.
CO4: Understand and incorporate the Software Quality standards and build a robust software.
CO5: Undertake problem identification, formulation and solution.
CO6: Design engineering solutions to complex problems utilising a systems approach.

TEXT AND REFERENCE BOOKS:

1. Software Engineering – A Practitioner's Approach, Roger S. Pressman, 1996, MGH.
2. Fundamentals of software Engineering, Rajib Mall, PHI
3. Software Engineering by Ian sommerville, Pearson Edu., 5th edition, 1999,AW,
4. Software Engineering – David Gustafson, 2002, T.M.H
5. Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson1995, JW&S
6. An Integrated Approach to Software Engineering by Pankaj jalote, 1991, Narosa.

WEB TECHNOLOGY

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Web Technology				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Understand the basics of HTML & Style sheets.
2. Understand the basics of server-side scripting using PHP.
3. Implement web application development procedures.

UNIT - I

Introduction to HTML: The development process, Html tags and simple HTML forms, web site structure Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS.

UNIT - II

Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc., Handling File Uploads, Connecting to database (My SQL as reference), executing simple queries, handling results, Handling sessions and cookies. File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.

UNIT - III

Client-side Scripting: Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. Simple AJAX applications.

UNIT - IV

XML : Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Create web pages using PHP
CO2: Identify the difference between the HTML PHP and XML documents.
CO3: Identify the engineering structural design of XML and parse tree
CO4: Analyze the difference between and PHP and XML.
CO5: Undertake problem identification, formulation and solution.
CO6: Design engineering solutions to complex problems utilising a systems approach.

TEXT AND REFERENCE BOOKS:

1. "Fundamentals of the Internet and the World Wide Web", Raymond Greenlaw and Ellen Hepp, TMH , latest edition.
2. "Internet & World Wide Programming", Deitel,Deitel & Nieto, Pearson Education
3. "Complete idiots guide to java script". Aron Weiss, QUE. "Network firewalls", Kironjeet syan - New Rider Pub.

DIGITAL IMAGE PROCESSING

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Digital Image Processing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To become familiar with digital image fundamentals.
2. To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
3. To learn concepts of degradation function and restoration techniques.
4. To study the image segmentation and representation techniques.
5. To become familiar with image compression and recognition method.

UNIT - I

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.

UNIT - II

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, color models, Pseudo coloring, color transforms, Basics of Wavelet Transforms.

UNIT - III

Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering.

UNIT - IV

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.

CO2: Operate on images using the techniques of smoothing, sharpening and enhancement.
CO3: Understand the restoration concepts and filtering techniques.
CO4: Learn the basics of segmentation, features extraction, compression and recognition methods for colour models.
CO5: Undertake problem identification, formulation and solution.
CO6: Design engineering solutions to complex problems utilizing a systems approach.

TEXT AND REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing Pearson, Third Edition,2010.
2. Anil K. Jain,Fundamentals of Digital Image Processing Pearson, 2002.
3. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
5. D,E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
6. William K. Pratt, Digital Image Processing John Wiley, New York, 2002
7. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

ADVANCE JAVA PROGRAMMING

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Advance Java Programming				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Programming in the Java programming language,
2. Knowledge of object-oriented paradigm in the Java programming language,
3. The use of Java in a variety of technologies and on different platforms.

UNIT - I

Servlet: Servlet introduction, web terminology, servlet API, servlet Interface, generic servlet, Http servlet, servlet lifecycle, servlet with IDE (eclipse, My eclipse, Net beans), servlet request, servlet collaboration, servlet configuration, context, attribute in servlet, session technique in servlet, event and listener, servlet filter, CRUD, pagination, input output stream, annotation, single thread model, SSI;

JSP: Lifecycle of JSP, JSPAPI, scripting elements, 9Implicit Objects, directive elements, Exceptions, action elements, expression language, MVC in JSP, JSTL, custom tags, pagination, CRUD, JSTL function, formatting, XML, SQL tags.

UNIT - II

Struts: Introduction, features, models, components, struts2 architecture, action, configuration, interceptors, validation method, aware Interfaces, stuts2withI18N, zero configuration, struts2withtiles, hibernate with struts2, spring with struts2, UI tags;

Mail API: java mail introduction, methods of sending email, sending mail by Gmail, receiving email, sending attachment, receiving attachment, sending html, forwarding, deleting email.

UNIT - III

Hibernate(HB): Introduction, architecture, HB with IDE, HB Log4j, inheritance mapping, HB mapping, transaction management, HB query language, HB criteria query language, named query, HB caching, integration, HB lifecycle;

Spring: Introduction, modules, spring with IDE, dependency injection methods, spring AOP, spring Jdbc template, spring ORM, SPEL, MVC tag library, applications, spring remoting, spring OXM, spring web, security models, spring boot, spring with angular.

UNIT - IV

Android: Introduction, history & versions, architecture, building blocks, emulator, android widgets, activity and intents, android fragments, android menu, android service, SQLite, XML & JSON, android speech, multimedia, telephony, maps;

Design Pattern: java design pattern, creational, structural, behavioral, J2EE patterns, presentation layers.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Knowledge of the structure and model of the Java programming language, (knowledge).
CO2: Use the Java programming language for various programming technologies (understanding).
CO3: Develop software in the Java programming language.
CO4: Demonstrate a sound technical knowledge of their selected project topic.
CO5: Undertake problem identification, formulation and solution.
CO6: Conduct an engineering project.

TEXT AND REFERENCE BOOKS:

1. Patrick Naught on and Herbertz Schidt, “Java-2 the complete Reference”,TMH
2. Sierra & bates, “Head First Java”, O’Reilly.
3. E. Balaguruswamy, “Programming with Java”,TMH
4. Horstmann, “Computing Conceptswith Java2 Essentials”, John Wiley.
5. Decker & Hirsh field, “Programming.Java”, Vikas Publication.

DISTRIBUTED SYSTEM

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Distributed System				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To examine the fundamental principles of distributed systems, and provide students hands-on experience in developing distributed protocols.
2. Analyze the issues in distributed operating systems and to address these distributed systems issues in a broader sense. Emphasis will be placed on communication, process, naming, synchronization and fault tolerance.

UNIT - I

Introduction: Distributed Operating Systems Definition and goals, Hardware and Software concepts, Design issues.

Communication in Distributed System: Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC

UNIT - II

Synchronization in Distributed System: Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems

Processes and processors in Distributed systems: Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, real time distributed systems, Process migration and related issues

UNIT - III

Distributed File systems: Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, case study.

Distributed Shared Memory: Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing

UNIT - IV

Security Issues: Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management

Distributed Web-based Systems: Architecture, Processes, Communication, Naming, Synchronization

Case Studies: JAVA RMI, Sun Network File System, Google Case Study

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: List the principles of distributed systems and describe the problems and challenges associated with these principles.

CO2: Understand Distributed Computing techniques, Synchronous and Processes.

CO3: Apply Shared Data access and Files concepts.

CO4: Design distributed system that fulfills requirements with regards to key distributed systems properties.

CO5: Understand Distributed File Systems and Distributed Shared Memory.

CO6: Apply Distributed web-based system and understand the importance of security in distributed system

TEXT AND REFERENCE BOOKS:

1. Distributed Operating Systems by Andrew S Tannebaum, Pearson
2. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI
3. Distributed Systems: Concepts and Design by George Coulouris, Jean Dollimore, TimKindberg, Pearson
4. Distributed Computing by Sunita Mahajan & Seema Shah OXFORD
5. Distributed Systems: Principles and Paradigms by Andrew S Tanebaum, Maarten Van Steen, PHI 6. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, HagitAttiya and Jennifer Welch, Wiley India

6TH SEMESTER

B.Tech. (Computer Science and Engineering- Artificial Intelligence & Machine Learning)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VI

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**PCC**		Compiler Design	3	0	0	3	3	30	70		100
2.	**PCC**		Statistical Computing	3	0	0	3	3	30	70		100
3.	**PCC**		Deep Learning	3	0	0	3	3	30	70		100
4.	**PEC**		Professional Elective Course - II	3	0	0	3	3	30	70		100
5.	**PEC**		Professional Elective Course - III	3	0	0	3	3	30	70		100
6.	**OEC**		Open Elective Course - II	3	0	0	3	3	30	70		100
7.	**LC**		Deep Learning Lab	0	0	2	2	1	50		50	100
8.	**LC**		Statistical Computing Lab	0	0	2	2	1	50		50	100
9.	**PROJECT**		Project - I	0	0	4	4	2	50		50	100
			Total	**18**	**0**	**8**	**26**	**22**	**330**	**420**	**150**	**900**

NOTE:

1. **At the end of the 6th semester, each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.**
2. **Choose any one from Professional Elective Course – II & III**
3. **Choose any one from Open Elective Course – II**

Professional Elective Course – II

1. Software Testing
2. Computer Graphics
3. Information Retrieval
4. Soft Computing
5. Internet of Things

Professional Elective Course – III

1. Network Security and Cryptography
2. Internet Technologies
3. Mobile applications development
4. Advance Database Management System
5. Cloud Computing

COMPILER DESIGN

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Compiler Design				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis.
3. Design top-down and bottom-up parsers.
4. Identify synthesized and inherited attributes.
5. Develop syntax-directed translation schemes.

UNIT - I

Introduction to Compilers: Language Processors, The Structure of compiler: its different phases, Compiler Construction Tools, Applications of Compiler Technology.

Lexical Analysis: Role of lexical analyzer, Input Buffering, Specification, and recognition of tokens, design of lexical analyzer, regular expressions, A language specifying lexical analyzer, Finite automata, conversion from regular expression to finite automata, and vice versa, minimizing the number of states of DFA, Implementation of lexical analyzer.

UNIT - II

Syntax Analysis: Role of parsers, context-free grammars.

Parsing Technique: Shift-reduce parsing, Operator precedence parsing, Top-down parsing, Predictive parsing.

UNIT - III

LR parsers, SLR, LALR, and Canonical LR parser.

Syntax Directed Translations: Syntax-directed definitions, construction of syntax trees, syntax-directed translation scheme, implementation of syntax-directed translation, Intermediate-Code Generation: three address code, quadruples and triples.

UNIT - IV

Symbol Table & Error Detection, and Recovery: Symbol tables: its contents and data structure for symbol tables; trees, arrays, linked lists, hash tables. Errors, lexical phase error, syntactic phase

error, and Semantic error. **Code Optimization & Code Generation:** Code generation, forms of objects code, machine-dependent code, optimization, register allocation for temporary and user defined variables.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: state principles of compiler design.
CO2: illustrate the essential phases for automatically converting source code into object code.
CO3: apply lexical analysis, syntax analysis and code optimization techniques for solving problems.
CO4: analyse a parse tree and a given BNF grammar.
CO5: compare and contrast syntax-oriented translation schemes.
CO6: design a lexical analyser from the specification of a language's lexical rules.

TEXT AND REFERENCE BOOKS:

1. Theory and practice of compiler writing, Tremblay & Sorenson, 1985, Mc. Graw Hill.
2. System software by Dhamdhere, 1986, MGH.
3. Principles of compiler Design, Narosa Publication
4. Elements compiler Design, Dr. M. Joseph, University Science Press
5. Compilers Principle, Techniques & Tools – Alfred V. AHO, Ravi Sethi & J.D. Ullman; 1998 Addison Wesley.

STATISTICAL COMPUTING

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Statistical Computing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Understand the basics of data, exploratory data analysis, statistics.
2. Demonstrate the concept of hypothesis testing in problem-solving.
3. Illustrate multivariate data analysis methods to solve the problems.
4. Understand the concepts of classification methods to analysis and representation of multivariate data in real world.

UNIT - I

Review of Descriptive Statistics and Probability Theory: Scale of measurement and data types, Descriptive statistics, Frequency Tables and graphs, Relative frequency tables and graphs, grouping data, histograms and ogive, mean, median, mode, variance and standard deviation of sample data, Sample spaces and events, Axioms, Conditional Probability, Independent event, Bayes Theorem, Binomial Theorem.

UNIT - II

Random Variable and Distributions: Random variables, type of random variables, Mean (Expectation) and variance of a discrete random variables, Discrete uniform distribution, Bernoulli's distribution, Binomial distribution, Geometric distribution, Poisson's distribution, Mean and variance of a continuous random variable, Continuous uniform distribution: normal distribution, exponential distribution, Central Limit Theorem.

UNIT - III

Hypothesis testing: determining levels of significance, Types of hypothesis testing errors, Hypothesis testing for population mean for large and small samples; Comparing two population means for large and small independent samples; Comparing two population means for paired samples; Comparing two population proportions, Chi-Square, t-test and F-test, Analysis of variance (ANOVA).

UNIT - IV

Multivariate Analysis: Multivariate distributions: multivariate normal distribution and its properties, distributions of linear and quadratic forms, Wishart distribution (definition, properties), union-intersection and likelihood ratio principles, inference on mean vector, Hotelling's T2. MANOVA- Inference on covariance matrices.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: define basic tools of data analysis**.**
CO2: explain the concepts given in descriptive and inferential statistics**.**
CO3: apply statistical concepts to solve real-world statistical computing problems.
CO4: analyse the trends in data using descriptive statistics.
CO5: interpret and evaluate statistical models**.**
CO6: conclude the findings of statistical analysis.

TEXT AND REFERENCE BOOKS:

1. Ross Sheldon M., Introduction to Probability and Statistics for Engineers and Scientists, 4th edition, Academic Press, 2009.
2. Douglas S. Shafer and Zhang Zhiyi, Beginning Statistics, 2012. [Available freely online under Creative Commons by-nc-sa 3.0 license]
3. Brain S. Everitt, A Handbook of Statistical Analysis Using R, Second Edition, LLC 2014
4. Roger D. Peng, R Programming for Data Science, Lean Publishing, 2015.
5. Michael J. Crawley, Statistics, An introduction using R, Second edition, John Wiley, 2015
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction, Springer, 2nd edition, 2009

DEEP LEARNING

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Deep Learning				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Introduce major deep learning algorithms, the problem settings, and their applications to solve real-world problems.
2. To introduce the idea of artificial neural networks and their architecture
3. To introduce techniques used for training artificial neural networks
4. To enable design of an artificial neural network for classification
5. To enable design and deployment of deep learning models for machine learning problems
6. To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

UNIT - I

Introduction: Definition, History of Deep Learning Deep Learning

Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing

UNIT – II

Artificial Neural Networks: McCulloch-Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm. Feed forward Networks: Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization.

Convolutional Networks: The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features- LeNet, AlexNet

UNIT - III

Recurrent Neural Networks: Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks - The Long Short-Term Memory and Other Gated RNNs

Generative Adversial Networks (GANs): Introduction, Discriminator, Generator, Activation, Common activation functions for GANs, BCE loss, Conditional GANs, Controllable generation, real life GANs

UNIT - IV

Deep Generative Models: Boltzmann Machines - Restricted Boltzmann Machines - Introduction to MCMC and Gibbs , Deep Belief Networks- Deep Boltzmann Machines

Optimization for Train Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the fundamentals of deep learning and the main research activities in this field.
CO2: Emphasizing knowledge on various deep learning algorithms.
CO3: Understanding of CNN and RNN to model for real-world applications.
CO4: Understanding the various challenges involved in designing deep learning algorithms for varied applications.
CO5: Implement deep learning algorithms and solve real-world problems.
CO6: Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.

TEXT AND REFERENCE BOOKS:

1. Nikhil Buduma, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm”, O’Reilly, 2017.
2. Ian Goodfellow, YoshuaBengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.
3. AurélienGéron, “Hands-On Machine Learning with Scikit- Learn and TensorFlow”, O’Reilly, 2017.
4. Nikhil Ketkar, “Deep Learning with Python: A Hands-on Introduction”, Apress, 2017.
5. Tariq Rashid, "Make your own neural network ", 2017.

DEEP LEARNING LAB

Semester	VI				
Course code					
Category	Laboratory course				
Course title	Deep Learning Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 5 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

COURSE OBJECTIVE

1. To Build the Foundation of Deep Learning.
2. To Understand How to Build the Neural Network.
3. To enable students to develop successful machine learning concepts.

CONTENTS

1. Setting up the Spyder IDE Environment and Executing a Python Program
2. Plotting of Activation Functions: Threshold functions, Signum function, Sigmoid function, Tan-hyperbolic function, Ramp function, Identity function.
3. Implementation of linearly separable concept for a problem.
4. Implementation of some basic model like MCP with suitable example
5. Installing Keras, TensorFlow and Pytorch libraries and making use of them
6. Applying the Convolution Neural Network on computer vision problems
7. Image classification on MNIST dataset (CNN model with Fully connected layer)
8. Applying the Deep Learning Models in the field of Natural Language Processing.
9. Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes.
10. Applying the Autoencoder algorithms for encoding the real-world data
11. Applying Generative Adversial Networks for image generation and unsupervised tasks.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: For a given conceptual problem student will be able to analyze the problem and able to visualize using NN.

CO2: Apply Artificial Neural Networks models to handle uncertainty and solve engineering problems.

CO3: Learn the Fundamental Principles of Deep Learning.

CO4: Identify the Deep Learning Algorithms for Various Types of Learning Tasks in various domains.

CO5: Implement Deep Learning Algorithms and solve Real-world problems.

STATISTICAL COMPUTING LAB

Semester	VI				
Course code					
Category	Laboratory course				
Course title	Statistical Computing Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 5 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Install R and R studio.
2. Two assignments related to descriptive statistics.
3. Two assignments related to visualizing trends in data.
4. Two assignments related to permutations, combinations and probability.
5. Two assignments on Hypothesis Testing.
6. Two assignments on linear regression.
7. Two assignments on logistic regression.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: implement statistical tools for drawing inference from data.

CO2: explore the trends in datasets using descriptive statistics.

CO3: apply probability, hypothesis testing and regression for solving research questions.

CO4: Judge different problem situations for applying appropriate statistical tests.

CO5: create lab records of assignment by incorporating problem definitions, design of solutions, results and interpretations.

CO6: create lab records of assignment by incorporating problem definitions, design of solutions, results and interpretations.

PROJECT - I

Semester	VI				
Course code					
Category	Project				
Course title	Project - I				
Scheme and Credits	L	T	P	Credits	
	0	0	4	2	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVE

1. To allow students to demonstrate skills learned during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation
2. To encourage research through the integration learned in a number of courses.
3. To allow students to develop problem solving skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and to give an oral presentation and prepare a technical report.

Students will be assigned projects (Applications/Research based) individually or in a group of not more than 3 students depending on the efforts required for completion of the project.

The project will have 4 stages: (*Marks for internal evaluation are given in brackets)

1. Synopsis submission (5 marks),
2. 1st mid-term progress evaluation (Literature Survey in case of research project) (5 marks)
3. 2nd mid-term progress evaluation (Paper Publishing/acceptance in a reputed Journal or Conference acceptance/ Presenting) (5 marks)
4. Final submission evaluation

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and/or publication and viva.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Demonstrate a sound technical knowledge of their selected project topic.
CO2: Undertake problem identification and formulation.
CO3: Design engineering formula to complex problems utilising a systems approach.
CO4: Research and engineering project.
CO5: Communicate with engineers and the community at large in written and oral form.
CO6: Demonstrate the knowledge, skills and attitudes of a professional engineer.

Professional Elective Course - II

SOFTWARE TESTING

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Software Testing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To study fundamental concepts of software testing including software testing objectives, process, criteria, strategies, and methods.
2. To learn how to plan a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
3. To gain an insight into techniques and skills on how to use modern software testing tools to support software testing projects.

UNIT - I

Introduction: Overview of Software Development Life Cycle (SDLC), Significance of Software Testing in SDLC, Objectives and Limitations of software testing. Difference between an Error, Fault and Failure (Software Bug), Software Testing Life Cycle (STLC) and Seven Principles of Software Testing, Role of Software Testing in Software Quality

UNIT - II

Test Case Design: Test Cases and Test Suite, Test Case Planning and Designing, Characteristics of Good Test Case Design, Format of test case.

Testing Activities: Levels of Testing- Unit, Integration Testing and System Testing. V Model for Software Testing.

UNIT - III

Types of Software Testing: Black box testing, White Box and Gray Box Testing.

Reporting and Analyzing bugs: Problem reports, Content and Characteristics of Problem Report, analysis

and Tactics for analyzing a reproducible bug. Making a bug reproducible, Problem/Bug Reporting tools.

UNIT - IV

Types of Software Testing: Black box testing, White Box and Gray Box Testing.

Reporting and Analyzing bugs: Problem reports, Content and Characteristics of Problem Report, analysis
and Tactics for analyzing a reproducible bug. Making a bug reproducible, Problem/Bug Reporting tools.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand software testing and quality as a fundamental component of software development life cycle.
CO2: Understand and design the test cases for a given problem
CO3: Understand the process of Reporting of software failures(bugs) using tools like Bugzilla
CO4: Develop the knowledge of selection of appropriate test cases for execution during regression testing.
CO5: Compare and contrast the various activities of Quality Assurance, Quality planning and Quality Control.
CO6: Conduct formal inspections, record and evaluate results of inspections.

TEXT AND REFERENCE BOOKS:

1. "Software Testing: Principles and Practices", by Naresh Chauhan. Oxford University Press
2. "William Perry, Effective Methods for Software Testing, John Wiley & Sons, New York, 1995.
3. Boris Beizer, Software Testing Techniques, Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
4. Louise Tamres, Software Testing, Pearson Education Asia, 2002
5. Roger S. Pressman, Software Engineering – A Practitioner's Approach, Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
6. Boris Beizer, Black-Box Testing – Techniques for Functional Testing of Software and Systems, John Wiley & Sons Inc., New York, 1995.
7. K.K. Aggarwal & Yogesh Singh, Software Engineering, New Age International Publishers, New Delhi, 2003.

COMPUTER GRAPHICS

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Computer Graphics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To have basic understanding of the core concepts of Computer Graphics.
2. Understand scan conversion, 2D, 3D – transformation and viewing.
3. To be able to create interactive computer Graphics with understanding of shading, image processing and illumination model.

UNIT - I

Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software; Two dimensional Graphics Primitives: Points and Lines, Scan Conversion: Point, Line, Circle; Region Filling: Scanline algorithm, Polygon filling algorithm, boundary filled algorithm.

UNIT - II

Two dimensional transformations: Geometric, Coordinate and, composite transformation.
Two Dimensional Viewing: window to view port mapping; Clipping: point, line, polygon, curve and text clipping

UNIT - III

Three-dimensional transformations: Three dimensional graphics concept, Geometric and Coordinate transformations, Viewing in 3D: Projection, Taxonomy of projection,
Hidden surface removal: Introduction to hidden surface removal, The Z- buffer algorithm, The painter's algorithm, Scanline algorithm, Sub-division algorithm.

UNIT - IV

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, BSpline curves. Parametric representation of surfaces; Interpolation method.
Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency, image processing.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: ***Understand and apply*** basics about computer graphics along with graphics standards.

CO2: Understanding of the software, hardware and applications of Computer Graphics.

CO3: Understanding of Scan conversion, 2D, 3D – transformation and viewing.

CO4: ***Understand*** various colour models in computer graphics system and develop animated motions through OpenGL.

CO5: To be able to implement picture on screen using projection, shading, image processing and illumination model.

TEXT AND REFERENCE BOOKS:

1. Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.
2. Computer Graphics by Donald Hearn and M.Pauline Baker, 2 Edition, 1999, PHI
3. Computer Graphics by Z. Xiang, R. Plastock, 2nd Edition, TMH Education.
4. Procedural Elements for Computer Graphics – David F. Rogers, T.M.H latest Edition
5. Fundamentals of 3-Dimensional Computer Graphics by Alan Watt, Addision Wesley.
6. Computer Graphics: Secrets and Solutions by Corrign John, BPB
7. Graphics, GUI, Games & Multimedia Projects in C by Pilania&Mahendra, Standard Publ.
8. Computer Graphics Secrets and solutions by Corrign John, BPV
9. Introduction to Computer Graphics by N. Krishanmurthy T.M.H latest edition

INFORMATION RETRIEVAL

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course Title	Information Retrieval				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To build an understanding of the fundamental concepts of Information Retrieval
2. To understand the elements of Web Search Engines and Crawlers
3. To familiarize students with the basic taxonomy and terminology of Indices and to understand Heap's Law for estimation and Zipf's law for modeling distribution of terms
4. To understand dictionary compression and posting list compression and to introduce the scoring , tf-idf weighting and vector space model for scoring

UNIT - I

Information retrieval problem, an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval, an inverted index, Bi-word indexes, Positional indexes, Combination schemes

UNIT - II

Search Engines: Basic Building Blocks and Architecture, Text Acquisition, Text Transformation, Index Creation, User Interaction, Ranking, Evaluation. **CRAWL AND FEEDS:** Crawling the Web, Retrieving Web Pages, The Web Crawler, Freshness, Focused Crawling, Deep Web, Crawling Documents and Email, Storing the Documents, Detecting Duplicates

UNIT - III

INDEX CONSTRUCTION AND COMPRESSION: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing **Index compression:** Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage, Postings file compression

UNIT - IV

SCORING, TERM WEIGHTING AND THE VECTOR SPACE MODEL: Parametric and zone indexes, Weighted zone scoring, Learning weights, The optimal weight, Term frequency and

weighting, Inverse document frequency, Tf-idf weighting, The vector space model for scoring , Computing scores in a complete search system.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand basic Information Retrieval Systems and learn how Boolean queries are processed.

CO2: Realize the data structures like Inverted Indices used in Information retrieval systems.

CO3: understand the basic concept of Search Engines their architecture and its various functional components and understand the basic concept of Web crawlers and their architecture

CO4: identify the different types of indices: inverted index, positional index, biword index and be able make estimations and model distribution of terms and compressions

CO5: enumerate various types of indices and also understand the concept of efficient storage of indices and learn tf-idf scoring and vector space model scoring for ranking.

TEXT AND REFERENCE BOOKS:

1. C.D.Manning, P. Raghavan and H.Schutze “Introduction to Information Retrieval”, Cambridge University Press, Latest Edition
2. B.Croft, D.Metzler, T.Strohman, “Search Engines : Information Retrieval in Practice”, AddisionWesley, Latest Edition

SOFT COMPUTING

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Soft Computing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide students an hand-on experience on MATLAB to implement various strategies.

UNIT - I

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

UNIT - II

FUZZY LOGIC: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT - III

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

UNIT - IV

GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Identify and describe soft computing techniques and their roles in building intelligent Machines.
CO2: Develop intelligent systems leveraging the paradigm of soft computing techniques.
CO3: Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.
CO4: Recognize the feasibility of applying a soft computing methodology for a particular problem.
CO5: Design the methodology to solve optimization problems using fuzzy logic, genetic algorithms.
CO6: Evaluate and compare solutions by various soft computing approaches for a given problem.

TEXT AND REFERENCE BOOKS:

1. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI
2. Satish Kumar, "Neural Networks: A classroom approach" Tata McGraw Hill.
3. Haykin S., "Neural Networks-A Comprehensive Foundations", PHI
4. Anderson J.A., "An Introduction to Neural Networks", PHI
5. M.Ganesh, "Introduction to Fuzzy sets and Fuzzy Logic" PHI.
6. N P Padhy and S P Simon, " Soft Computing with MATLAB Programming", Oxford University Press

INTERNET OF THINGS

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course Title	Internet of Things				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Student will be able to learn the basics of IOT.
2. Student will be able to analyse basic protocols of wireless and MAC.
3. Students will get familiar with web of things.
4. Students will get basic knowledge of resource management.

UNIT - I

INTRODUCTION TO IOT: Introduction to IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs ,IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network, Challenges in IoT(Design ,Development, Security)

UNIT - II

NETWORK AND COMMUNICATION ASPECTS: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

UNIT - III

WEB OF THINGS: Web of Things vs Internet of things, two pillars of web, Architecture and standardization of IoT, Unified multitier-WoT architecture, WoT portals and Business intelligence, Cloud of things: Grid/SOA and cloud computing, Cloud middleware, cloud standards

UNIT - IV

RESOURCE MANAGEMENT IN IOT: Domain specific applications of IoT, Home automation, Industry applications, Surveillance applications, Other IoT applications Clustering, Synchronization, Software agents.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: **Understand** the basics of application areas of IOT.
CO2: Analyze basic protocols network.
CO3: Explain and realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
CO4: Discuss the architecture, operation, and business benefits of an IoT solution
CO5: Examine the potential business opportunities that IoT can uncover
CO6: Explore the relationship between IoT, cloud computing, and big data and Identify how IoT differs from traditional data collection system

TEXT AND REFERENCE BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Professional Elective Course - III

NETWORK SECURITY AND CRYPTOGRAPHY

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Network Security And Cryptography				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To understand cryptography theories; algorithms & systems.
2. To understand the symmetric and asymmetric key algorithms.
3. To understand necessary approaches & techniques to build protection mechanisms in order to secure Computer Networks.
4. Acquire fundamental knowledge on the concepts of different security layers.

UNIT - I

Introduction: Plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography.

UNIT - II

Symmetric Key Algorithms: Introduction, algorithms types and modes, DES, AES.

Asymmetric Key Algorithms: Introduction, history of asymmetric key cryptography, RSA symmetric and asymmetric key cryptography together, Digital signature.

UNIT - III

Internet Security Protocols: Basic concepts, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Hyper Text Transfer protocol (SHTTP), Time Stamping Protocol (TSP), Secure Electronic Transaction (SET), S SL versus SET, Electronic Money, Email Security.

UNIT - IV

User Authentication And Kerberos: - Introduction, Authentication basics, Passwords, authentication tokens, certificate-based authentication, biometric-based authentication, Kerberos, key distribution center(KDC), Security handshake pitfalls, single Sign on(SSO) approach.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Identify services that enhance the security and its mechanism.

CO2: Classify security attacks on information over network. Describe and apply classical encryption techniques.

CO3: Explain and apply modern block cipher with modes

CO4: Compare conventional encryption algorithms & public key cryptography, and design Encryption algorithm to provide the Integration and confidentiality of a message.

CO5: Understand the concept of hash function with application and message authentication code in security system

CO6: Classify key management schemes and discuss web security and transport level security protocols.

TEXT AND REFERENCE BOOKS:

1. Cryptography and Network Security, 2nd Edition by Atul Kahate, TMH
2. Network Management Principles & Practices by Subramanian, Mani (AWL)
3. SNMP, Stalling, Willian (AWL)
4. SNMP: A Guide to Network Management (MGH)
5. Telecom Network Management by H.H. Wang (MGH)
6. Network Management by U. Dlack (MGH)

INTERNET TECHNOLOGIES

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Internet Technologies				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

UNIT - I

WEB SERVERS: Web Protocols- Working of web browser - Browser & Server Communication - Web Server Functions - Web Security - Fire Wall - Proxy Servers - Virtual Directories - MIME - HTTP Headers - Deployment using web servers.

WEB PROGRAMMING: HTML5 Structural Elements-Images - HTML5 Form Elements and Attributes - DHTML - CSS3-Selectors-Box model-Positioning elements-Colors-Shadows-Gradients-Transitions and Transformations.

UNIT - II

JAVASCRIPT: Java Script - Core JavaScript - lexical structure- types-values and variables-expression and operators-statements-objects arrays-functions- classes and modules- pattern matching with regular expressions- java script in web browser-the window objects scripting documents-handling events.

UNIT - III

ANGULARJS: An Overview of the AngularJS Life Cycle-Integrating AngularJS with Existing JavaScript and jQuery-Adding AngularJS to the Node.js Environment-Bootstrapping AngularJS in an HTML Document- Creating a Basic AngularJS Application-Using AngularJS Templates to Create Views- Implementing Directives in AngularJS Views- Implementing AngularJS Services in Web Applications.

NODE.JS: Using Events, Listeners, Timers, and Callbacks in Node.js-5 Handling Data I/O in Node.js- Accessing the File System from Node.js- Implementing HTTP Services in Node.js-implementing Socket Services in Node.js- Scaling Applications Using Multiple Processors in Node.js- Implementing Express in Node.js

UNIT - IV

MONGODB: Understanding NoSQL and MongoDB- Manipulating MongoDB Documents from Node.js- Accessing MongoDB Documents from Node.js- Advanced MongoDB Concepts

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understanding of the concept of the web servers and its working.
CO2: Analyze a web page and identify its elements and attributes.
CO3: Build dynamic web pages using JavaScript (Client side programming).
CO4: Acquire in depth knowledge in web services using the latest server-side technologies.
CO5: Ability to design and develop web server applications using Node JS and Angular JS.
CO6: Demonstrate the connectivity of web pages and database like NoSQL and MongoDB.

TEXT AND REFERENCE BOOKS:

1. Deitel & Deitel, "Internet & World Wide Web How to Program", Pearson Education India, fifth Edition, 2011.
2. David Flanagan "JavaScript: The Definitive Guide, O'Reilly Media, Inc. May 2011.
3. Brad Dayley "Node.js, MongoDB, and AngularJS Web Development", Addison-Wesley Professional. 2014
4. Brad Green, Shyam Seshadri "AngularJS", O'Reilly; 1st Edition Apr 2013.
5. Negrino and Smith, "Javascript for the World Wide Web", 5th Edition, Peach pit Press,2003

MOBILE APPLICATIONS DEVELOPMENT

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Mobile applications development				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Introduce the students with the various "Next Generation Technologies" in the area of mobile computing
2. Assist students understand the various Mobile operating Systems
3. Explore the findings using Android Technologies

UNIT - I

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features

UNIT - II

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.

UNIT - III

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.

UNIT - IV

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment. iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Explain the principles and theories of mobile computing technologies.
CO2: Describe infrastructures and technologies of mobile computing technologies.
CO3: List applications in different domains that mobile computing offers to the public, employees, and businesses.
CO4: Describe the possible future of mobile computing technologies and applications.
CO5: Effectively communicate course work through written and oral presentations

TEXT AND REFERENCE BOOKS:

1. Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition:
2. Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.
3. Barry Burd, "Android Application Development All in one for Dummies", Edition: I
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS
5. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons
6. Henry Lee, Eugene Chuvyrov, "Beginning Windows Phone App Development", Apress, latest edition.
7. Jochen Schiller,"Mobile Communications", Addison-Wesley, latest edition
8. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.

ADVANCE DATABASE MANAGEMENT SYSTEM

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Advance Database Management System				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To understand DBMS Components, Advantages and Disadvantages.
2. Understanding Data modeling: ER, EER, Network, Hierarchical and Relational data models.
3. Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
4. To understand transaction concept, schedules, serializability, locking and concurrency control protocols.

UNIT - I

Introduction: Architecture, Advantages, Disadvantages, Data models, relational algebra, SQL, Normal forms.

Query Processing: General strategies for query processing, transformations, expected size, statistics in estimation, query improvement. Query evaluation, view processing, query processor.

UNIT - II

Recovery: Reliability, Transactions, recovery in centralized DBMS, reflecting updates, Buffer management logging schemes, disaster recovery.

Concurrency: Introduction, Serializability, Concurrency control, locking schemes, Timestamp based ordering, Optimistic, Scheduling, Multi-version techniques, Deadlocks.

UNIT - III

Parallel and Distributed Databases: Distributed Data Storage – Fragmentation & Replication, Location and Fragment.

Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

UNIT - IV

Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Students will get understanding of DBMS Components, Its advantages and disadvantages.

CO2: Understanding about various types of Data modeling: ER, EER, Network, Hierarchical and Relational data models.

CO3: Explain the concept of distributed database architecture & design and web technology using databases.

CO4: Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.

CO5: Understanding transaction concept, schedules, serializability, locking and concurrency control protocols.

TEXT AND REFERENCE BOOKS:

1. Elmarsi, Navathe, Somayajulu, Gupta, "Fundamentals of Database Systems", 4th Edition, Pearson Education,2007
2. Garcia, Ullman, Widom, "Database Systems, The complete book", Pearson Education, 2007
3. R. Ramakrishnan, "Database Management Systems", McGraw Hill International Editions, 1998
4. Date, Kannan, Swaminathan, "An Introduction to Database Systems", 8th Edition Pearson Education, 2007 2
5. Singh S.K., "Database System Concepts, design and application", Pearson Education, 2006.
6. Silberscatz, Korth, Sudarshan, "Database System Concepts", Mcgraw Hill, 6th Edition, 2006
7. W. Kim, "Modern Database Systems", 1995, ACM Press, Addision Wesley

CLOUD COMPUTING

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Cloud Computing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

UNIT - I

INTRODUCTION TO CLOUD COMPUTING: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

UNIT - II

CLOUD COMPUTING ARCHITECTURE: Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise .

UNIT - III

SECURITY ISSUES IN CLOUD COMPUTING: Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

SECURITY MANAGEMENT IN THE CLOUD: Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS Privacy Issues Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

UNIT - IV

AUDIT AND COMPLIANCE: Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a Cloud.

DATA INTENSIVE COMPUTING: Map-Reduce Programming Characterizing Data-Intensive Computations, Technologies for Data- Intensive Computing, Storage Systems, Programming Platforms, MapReduce Programming, MapReduce Programming Model, Example Application

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Recall and summarize the basic concepts of cloud computing
CO2: Discuss the architectural design of cloud and illustrate various programming models.
CO3: Outline the virtualization technology and determine their uses.
CO4: Explain the basic threats and security mechanism in cloud
CO5: Summarize the cloud available platforms for business and industry perspective

TEXT AND REFERENCE BOOKS:

1. "Cloud Computing Explained: Implementation Handbook for Enterprises", John Rhoton, Publication Date: November 2, 2009
2. "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)", Tim Mather, ISBN-10: 0596802765,O'Reilly Media, September 2009