**M.D. UNIVERSITY, ROHTAK**

**SCHEME OF STUDIES AND EXAMINATION**

**Common for**

**B. TECH CSE (Artificial Intelligence and Machine Learning)**
**B. TECH (Artificial Intelligence and Machine Learning)**
**B. TECH CSE (Artificial Intelligence)**
**And**
**B. TECH (Artificial Intelligence)**
**3rd year**

**Modified G Scheme effective from 2024-25**

**COURSE CODE AND DEFINITIONS**

| Course Code | Definitions |
|---|---|
| L | Lecture |
| T | Tutorial |
| P | Practical |
| BSC | Basic Science Courses |
| ESC | Engineering Science Courses |
| HSMC | Humanities and Social Sciences including Management courses |
| PCC | Professional core courses |
| OEC | Open Elective courses |
| LC | Laboratory course |
| MC | Mandatory courses |
| PROJ | Project |

**Modified G Scheme effective from 2023-24**

**B. TECH CSE (Artificial Intelligence and Machine Learning)**

**B. TECH (Artificial Intelligence and Machine Learning)**

**B. TECH CSE (Artificial Intelligence)**

**And**

**B. TECH (Artificial Intelligence)**

**Scheme of Studies/Examination**

**Modified G Scheme effective from 2023-24**

**Semester-5**

| Sr. No. | Course Code | Course Title | Hours per week | | | Total Contact Hrs. per week | Credit | Examination Schedule (Marks) | | | | Duration of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | | Internal Assessment | Theory | Practical | Total | |
| 1 | PCC-CSE-401G | Neural Networks (common with B.Tech.(CSE) in semester 7) | 3 | 0 | 0 | 3 | 3 | 25 | 75 | - | 100 | 3 |
| 2 | PCC-CSE-309G | Programming in JAVA (common with B.Tech.(CSE) in semester 5) | 3 | 0 | 0 | 3 | 3 | 25 | 75 | - | 100 | 3 |
| 3 | HSMC-01G | Economics for Engineers (Common for all branches) | 3 | 0 | 0 | 3 | 3 | 25 | 75 | - | 100 | 3 |
| 4 | PCC-AIML-351G | Recommender Systems | 3 | 0 | 0 | 3 | 3 | 25 | 75 | - | 100 | 3 |
| 5 | Refer to Annexure-I | Professional Elective-I | 3 | 0 | 0 | 3 | 3 | 25 | 75 | - | 100 | 3 |
| 6 | *MC-106G | Environmental Sciences | 3 | 0 | 1 | 4 | 0 | - | - | - | - | 3 |
| 7 | LC-CSE-421G | Neural Networks Lab (common with B.Tech.(CSE) in semester 7) | 0 | 0 | 2 | 2 | 1 | 25 | - | 25 | 50 | 3 |
| 8 | LC-AIML-371G | Data Visualization Lab | 0 | 0 | 2 | 2 | 1 | 25 | - | 25 | 50 | 3 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | LC-AIML-373G | Recommender Systems Lab | 0 | 0 | 2 | 2 | 1 | 25 | - | 25 | 50 | 3 |
| 10. | LC-CSE-327G | Programming in JAVA Lab (common with B.Tech.(CSE) in semester 5) | 0 | 0 | 2 | 2 | 1 | 25 | - | 25 | 50 | 3 |
| 11. | PT-CSE-329G | Practical Training -I | 2 | 0 | 0 | 2 | 0 | - | - | - | - | - |
| Total | | | | | | | 19 | | | | 700 | |

*__MC-106G__ is a mandatory non–credit course in which the students will be required passing marks in theory.

***Note-1: Practical Training I: The evaluation of Practical Training-I will be based on the seminar, viva-voce, report submitted by the students. According to performance, the students will be awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.***

**Grades :** Excellent: A, Good : B, Satisfactory: C, Not Satisfactory: F

**B. TECH (Artificial Intelligence and Machine Learning)**
**B. TECH CSE (Artificial Intelligence)**
**and**
**B. TECH (Artificial Intelligence)**
**Scheme of Studies/Examination**
**Modified G Scheme effective from 2023-24**
**Semester-6**

| Sr. No | Course Code | Course Title | Hours per week | | | Contact Hrs. per week | Credit | Examination Schedule (Marks) | | | | Duration of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | | Internal Assessment | Theory | Practical | Total | |
| 1 | PCC-CSE-352G | Data Science (Common with CSE in sem 6: Elective) | 3 | 0 | 0 | 3 | 3 | 25 | 75 | | 100 | 3 |
| 2 | PCC-AIML-354G | Introduction to R Programming | 3 | 0 | 0 | 3 | 3 | 25 | 75 | | 100 | 3 |
| 3 | PCC-CSE-356G | Big Data Analytics (Common with CSE in sem 8) | 3 | 0 | 0 | 3 | 3 | 25 | 75 | | 100 | 3 |
| 4 | HSMC-02G | Organizational Behaviour | 3 | 0 | 0 | 3 | 3 | 25 | 75 | | 100 | 3 |
| 5 | PCC-CSE-305G | Formal Languages & Automata (common with B.Tech.(CSE) in semester 5) | 3 | 0 | 0 | 3 | 3 | 25 | 75 | | 100 | 3 |
| 6 | Refer to Annexure-I | Professional Elective-II | 3 | 0 | 0 | 3 | 3 | 25 | 75 | - | 100 | 3 |
| 7 | Refer to Annexure-I | Professional Elective-III | 3 | 0 | 0 | 3 | 3 | 25 | 75 | - | 100 | 3 |
| 8 | LC-CSE-350G | Project-I (Common with CSE in sem) | 0 | 0 | 4 | 4 | 2 | 25 | - | 25 | 50 | 3 |
| 9 | LC-AIML-370G | Data Science Lab | 0 | 0 | 2 | 2 | 1 | 25 | - | 25 | 50 | 3 |
| 10 | LC-AIML-372G | R Programming Lab | 0 | 0 | 2 | 2 | 1 | 25 | - | 25 | 50 | 3 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | LC-CSE-364G | Big Data Analytics Lab (Common with CSE in sem 8) | 0 | 0 | 2 | 2 | 1 | 25 | - | 25 | 50 | 3 |
| 12. | MC-317G | Constitution of India | 2 | 0 | 0 | 2 | 0 | - | - | - | - | - |
| Total | | | | | | | 26 | 275 | 525 | 100 | 900 | |

*__MC-317G__ is a mandatory non–credit course in which the students will be required passing marks in theory.

**NOTE**: At the end of 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 typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

**Annexure- I**

**Elective –I (Professional Elective Course)**

1. PEC-CSE-311G: Software Engineering
2. PEC-CSE-314G: Computer Graphics
4. PEC-DS-309G : DevOps Overview
5. PEC-AI-308G : Nature Inspired Computing Techniques

**Elective –II (Professional Elective Course)**

1. PEC-CSE-310G: Advanced Database Management System
2. PEC-CSE-315G : Digital Image Processing
3. PCC-CSE-3O2G : Compiler Design
4. PEC-DS-314G: NoSQL Database
5. PEC-DS-316G: UX/UI Design

**Elective –III (Professional Elective Course)**

1. PEC-CSE-316G: Distributed System
2. PEC-CSE-332G : VHDL and Digital Design
3. PEC-DS-312G: Business Intelligence and Analytics
4. PEC-DS-405G: Advanced Python Programming
5. PCC-AI-403G : Applied Machine Learning

| NEURAL NETWORKS | | | | | |
|---|---|---|---|---|---|
| Course code | PCC-CSE-401G | | | | |
| Category | Professional Core Course | | | | |
| Course title | NEURAL NETWORKS | | | | |
| Scheme and Credits | L | T | P | Credits | Semester 5 |
| | 3 | 0 | 0 | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**Course Objectives**

1. To understand the different issues involved in the design and implementation of Neural Networks.
2. To study the basics of neural networks and its activation functions.
3. To understand and use of perceptron and its application in real world
4. To develop an understanding of essential NN concepts such as: learning, feed forward and feed backward
5. To design and build a simple NN model to solve a problem

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Overview of biological neurons: Structure of biological neuron, neurobiological analogy, Biological neuron equivalencies to artificial neuron model, Evolution of neural network. Activation Functions: Threshold functions, Signum function, Sigmoid function, Tan-hyperbolic function, Stochastic function, Ramp function, , Linear function, Identity function. ANN Architecture: Feed forward network, Feed backward network, single and multilayer network, fully recurrent network,

UNIT 2

McCulloch and Pits Neural Network (MCP Model): Architecture, Solution of AND, OR function using MCP model, Hebb Model: Architecture, training and testing, Hebb network for AND function. Perceptron Network: Architecture, training, Testing, single and multi-output model, Perceptron for AND function Linear function, application of linear model, linear seperatablity, solution of OR function using liner seperatablity model.

UNIT 3

Learning: Supervised, Unsupervised, reinforcement learning, Gradient Decent algorithm, generalized delta learning rule, Habbian learning, Competitive learning, Back propogation Network: Architecture, training and testing,

UNIT 4

Associative memory: Auto associative and Hetro associative memory and their architecture, training (insertion) and testing (Retrieval) algorithm using Hebb rule and Outer Product rule. Storage capacity, Testing of associative memory for missing and mistaken data, Bidirectional memory

**Course Outcomes:**

1. For a given conceptual problem student will able to analyze the problem and able to visualize in NN
2. Students will be familiar with different NN models.
3. Students will be able to understand the concept of learning in NN.

Text Books:

1. Introduction to artificial Neural systems by Jacek M. Zurada, 1994, Jaico Publ. House.
2. Principles of Soft Computing by S.N. Deepa, S.N. Sivanandam., Weley publication

Reference Books:

1. “Neural Networks :A Comprehensive formulation”, Simon Haykin, 1998, AW
2. “Neural Networks”, Kosko, 1992, PHI.
3. “Neural Network Fundamentals” – N.K. Bose , P. Liang, 2002, T.M.H
4. Neural Network , T.N.Shankar, University Science Press
5. Neuro Fuzzy Systems, Lamba, V.K., University Science Press

| **PROGRAMMING IN JAVA** | | | | | |
|---|---|---|---|---|---|
| Course code | PCC-CSE-309G | | | | |
| Category | Professional Core Course | | | | |
| Course title | Programming in JAVA | | | | |
| Scheme and Credits | L | T | P | Credits | Semester 5 |
| | 3 | 0 | 0 | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**Course Objectives:**

- Programming in the Java programming language.
- Knowledge of object-oriented paradigm in the Java programming language.

- The use of Java in a variety of technologies and on different platforms.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Unit 1:**

**Introduction to Java:** Evolution of Java, Object Oriented Programming Structure, Overview and characteristics of Java, Java program Compilation and Execution Process, Organization of the Java Virtual Machine, Client side Programming, Platform Independency & Portability, Security, Relation b/w JVM, JRE and JDK, Introduction to JAR format, Naming Conventions, Data types & Type casting, operators, Security Promises of the JVM, Security Architecture and Security Policy, security aspects, sandbox model

**Unit 2:**

**OOPS Implementation:** Classes, Objects, attributes, methods, data encapsulation, reference variables, Constructors, Anonymous block, Method Overloading, Static Data members, Block & methods; Memory Structure: Stack, Heap, Class & Method area Class loading & Execution flow: Static vs Dynamic Class loading, implicit vs explicit class loading, class loading operations; Argument Passing Mechanism: Passing primitive arguments, passing objects, Wrapper Classes; This keyword: Referencing instance members, Intra class constructor chaining, Method chaining; Inheritance & code reusability: Extending classes for code reusability, Usage of super keyword, Method Overriding, Object class

**Inheritance & Runtime Polymorphism:** Static & Dynamic binding, Inheritance and Is-A relation, Runtime Polymorphism and Generalization, Abstract classes & methods, Final Keyword;
Interfaces and Role based Inheritance: Feature & Role based Inheritance, Static & Dynamic classing Environment, classes & interfaces, interface applications in real scenarios; Has-A relation: Aggregation & Composition, Nested classes, Inner classes, Anonymous Inner classes, String Buffer Class, tokenizer, applets, Life cycle of applet and Security concerns

**Unit 3:**

**Threads:** Creating Threads, Thread Priority, Blocked States, Extending Thread Class, Runnable Interface, Starting Threads, Thread Synchronization, Synchronize Threads, Sync Code Block, Overriding Synced Methods, Thread Communication, wait, notify and notify all.

**Swing & AWT:**

Swing class hierarchy, containers, user interface components, graphics context, AWT Components, Component Class, Container Class, Layout Manager Interface Default Layouts, Insets and Dimensions, Border Layout, Flow Layout, Grid Layout, Card Layout Grid Bag

Layout AWT Events, Event Models, Listeners, Class Listener, Adapters, Action Event Methods Focus Event Key Event, Mouse Events, Window Event

**Package & Scopes:** Need of Packages, associating classes to Packages, Class path environment variable, Import Keyword and Feature of static import, Public, protected, private & default scope, Private Inheritance;

**Exception Handling:** exception and error, Exception Handling & Robustness, Common Exceptions and Errors, Try and catch block, Exception handlers, throw keyword, Checked and Unchecked Exceptions, Role of finally, User defined Exceptions;

**Unit 4:**

**Collection Framework:** Role and Importance of Collection Framework, List & Set based collection, Iterator & List Iterator, Maps, Searching elements in List, Hash and Tree based collections, Role of equals and hashCode() methods, Comparable and Comparator Interfaces, Thread Safety and Vector, Difference b/w Enumeration and Iterator, Type safety and Generics, Common algorithms and Collections class, Using Properties class for managing properties files; Database Connectivity Using JDBC: Overview of native and ODBC Drives, Introduction to

JDBC, Type of JDBC drivers, Usage of drivers, Defining properties-based Connection Factory; Basic database operations: Insert, Delete, Update, and Select; Prepared Statement: Statement, Prepared Statement, Setting Query parameters, Executing Queries;

**Callable Statement:** Creating PL/SQL Stored procedures and functions, Creating Callable statements, Executing procedures & functions, Batch Updation, Transacting Queries, Programmatic initialization of database, ResultSetMetaData, DatabaseMetaData;

Input/Output Stream, Stream Filters, Buffered Streams, Data input and Output Stream, Print Stream Random Access File,

**Reflection:** reflection API, newInstance()method, javap tool, creating javap tool, creating applet viewer, call private method, java 9 features;

**Text Books:**


1. Patrick Naughton and HerbertzSchidt, "Java-2 the complete Reference", TMH
2. Sierra & bates, "Head First Java", O'Reilly. **Reference Books:**

**1.** E. Balaguruswamy, "Programming with Java", TMH
**2.** Horstmann, "Computing Concepts with Java 2 Essentials", John Wiley.
**3.** Decker &Hirshfield, "Programming.Java", Vikas Publication.


**Course Outcomes:**

- Knowledge of the structure and model of the Java programming language, (knowledge)
- Use the Java programming language for various programming technologies (understanding)
- Develop software in the Java programming language

| ECONOMICS FOR ENGINEERS | | | | | |
|---|---|---|---|---|---|
| Course code | HSMC-01G | | | | |
| Category | Engineering Science Course | | | | |
| Course title | Microprocessor | | | | |
| Scheme and Credits | L | T | P | Credits | Semester 5 |
| | 3 | 0 | | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

Course Objectives: 1. Acquaint the students to basic concepts of economics and their operational significance. 2. To stimulate the students to think systematically and objectively about contemporary economic problems.

UNIT-1

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 2

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-3

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-4

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 OUT COMES:

1. The students will able to understand the basic concept to economics.
2. The student will able to understand the concept to production and cost.
3. The student will able to understand the concept of market.
4. The student will able to understand the concept of privatization, globalization and banks.

REFERENCES:


1. Jain T. R., Economics for Engineers, V K Publication.
2. Chopra P. N., Principle of Economics, Kalyani Publishers.
3. Dewett K. K., Modern economic theory, S. Chand. 4. H. L. Ahuja., Modern economic theory, S .Chand.
5. Dutt Rudar & Sundhram K. P. M., Indian Economy.
6. Mishra S. K., Modern Micro Economics, Pragati Publications.
7. Singh Jaswinder, Managerial Economics, dreamtech press.
8. A Text Book of Economic Theory Stonier and Hague (Longman's Landon).
9. Micro Economic Theory–M. L. Jhingan (S. Chand).
10. Micro Economic Theory-H. L. Ahuja (S. Chand).
11. Modern Micro Economics: S. K. Mishra (Pragati Publications).
12. Economic Theory-A. B. N. Kulkarni & A. B. Kalkundrikar( R. Chand & Co).

| RECOMMENDER SYSTEMS | | | | | |
|---|---|---|---|---|---|
| Course code | PCC-AIML-351G | | | | |
| Category | Professional Core Course | | | | |
| Course title | Recommender Systems | | | | |
| Scheme and Credits | L | T | P | Credits | Semester 5 |
| | 3 | 0 | | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Course Objectives:**

1. To provide students with the basic concepts of Recommender Systems
2. To design space, trade-offs of Recommender Systems
3. To Understand its application in various domains

**UNIT 1**

Introduction to Recommender Systems: Introduction and basic taxonomy of recommender systems – Traditional and non-personalized Recommender Systems, Overview of data mining methods for recommender systems, similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD), Applications of recommendation systems, Issues with recommender system:The cold-start problem.

**UNIT 2**

Content-based Recommender System: Architecture of Content-based Systems, Advantages and Drawbacks of Content-based Filtering, Content representation and content similarity, Item profiles, discovering features of data, obtaining item features from tags, representing item profiles, Learning User Profiles and Filtering, Similarity-based retrieval, Classification algorithms, Knowledge base recommendation: Knowledge representation and reasoning, constraint-based recommenders, Case based recommenders.

**UNIT 3**

Collaborative filtering-based Recommender System: Understanding ratings and rating data, User-based nearest-neighbor recommendation: Similarity Function, User-Based Algorithms Item-based nearest neighbor recommendation: Similarity Function, Item-Based Algorithms, Further model-based and preprocessing-based approaches, Comparing User-Based and Item-Based recommendations.

## UNIT 4

Evaluating Recommender Systems: Introduction, General properties of evaluation research, Popular evaluation designs, Evaluation on historical datasets, Alternate evaluation designs. Community-Based Web Search- The Collaborative Web Search System. Shared Web Search - The HeyStaks System, The HeyStaks Recommendation Engine. Social Tagging Recommenders Systems- Folksonomy, The Traditional Recommender Systems Paradigm, BibSonomy as Study Case, Tag Acquisition, Trust and Recommendations- Introduction, Computational Trust, Trust-Enhanced Recommender Systems

**Course Outcomes:**

After completing the course the student will be able to:

1. To understand basic techniques and problems in the field of recommender systems and its applications.
2. Analyze the different approaches towards recommendation.
3. Apply algorithms and techniques and evaluate the effectiveness of the recommender system.
4. Design recommender systems.

**Suggested Books:**

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed

2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer (2011), 1st ed.

3. Suresh Kumar Gorakala, Building Recommendation Engines, Packt Publishing(2016)

4. Aggarwal, C. C. Recommender Systems: The Textbook. Springer 2016

| Environment Science | | | | | |
|---|---|---|---|---|---|
| Course code | MC-106G | | | | |
| Category | Mandatory Course | | | | |
| Course title | Environment Science | | | | |
| Scheme and Credits | L | T | P | Credits | Semester 5 |
| | 3 | 0 | | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

Unit-1

The Multidisciplinary nature of environment studies. Definition, scope and importance. (2 lecture)

Unit-2

Natural Resources (7 Lectures): Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources: Use and over-exploitation: deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies. e) Energy resources: Growing energy needs; renewable and non-renewable energy sources, use of alternate energy sources, case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. g) Role of an individual in conservation of natural resources. h) Equitable use of resources for sustainable lifestyles (8 lectures)

Unit-3

Ecosystems : a) Producers, consumers and decomposers. b) Energy flow in the ecosystem. c) Ecological succession. d) Food chains, food webs and ecological pyramids. e) Introduction, types, characteristic features, structure and function of the following eco-system : f) Forest ecosystem. g) Grassland ecosystem. h) Desert ecosystem. i) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

Unit-4

Biodiversity and its conservation : a) Introduction - Definition: Genetic, Species and ecosystem diversity. b) Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. c) Biodiversity at global, National and local levels. d) India as a mega-diversity nation. e) Hot-spots of biodiversity. f) Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. g)

Endangered and endemic species of India. h) Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. (8 lectures)

Unit-5

Environmental pollution : Definition, causes, effects and control measures of: a) Air pollution. b) Water pollution c) Soil pollution d) Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear hazards * Solids waste management: causes, effects and control measures of urban and industrial wastes. * Role of an individual in prevention of pollution. * Pollution case studies. * Disaster management: floods, earthquake, cyclone and landslides. (8 lectures)

Unit-6

Social issues and the Environment : From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: its problems and concerns case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of pollution) Act. Water (Prevention and Control of pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. (7 lectures)

Unit-7

Human population and the Environment, Population growth, variation among nations, Population explosion- Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/AIDS, Woman and Child Welfare, Role of Information Technology in Environment and human health, Case Studies. Unit-8 Field Work (Field work equal to 10 lecture hours): Visit to a local area to document environmental assets - river/forest/grassland/hill/mountain. Visit to a local polluted site-urban/Rural/ Industrial/ Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc. (6 lectures)

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Pub. Ltd. Bikaner.

2. Bharucha, Frach, The Biodiversity of India, MApin Publishing Pvt. Ltd. Ahmedabad-380013, India, E-mail: mapin@icenet.net (R).

3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw Hill Inc. 480p.

4. Clark R.S., Marine pollution, Slanderson Press Oxford (TB).

5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai 1196 p.

6. De A.K., Environmental Chemistry, WileyEastern Ltd.

7. Down to Earth, Centre for Science and Environment (R).

8. Gleick, H.P., 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute, Oxford Univ. Press, 473p.

9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural HistorySociety, Bombay(R).

10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge Uni. Press 1140p.

11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.

12. Mackinney, M.L. & Schoch, RM 1996, Environmental Science systems & solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Mayyer Hazardous, Tekchno-Science Publications (TB). Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB).
15. Odum, E.P. 1971, Fundamentals of Ecology. W.B. Saunders Co. USA, 574p.
16. Rao M.N. & Datta, A.K. 1987 Waste Water Treatment. Oxford & TBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma, B.K. 2001, Environmental Chemistry, Goal Publ. House, Meerut.
18. Survey of the Environment, The Hindu (M).
19. Townsend C., Harper J. and Michael Begon. Essentials of Ecology, Blackwell Science (TB).
20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Comliances and Standards, Vol. I and II Enviro Media (R).
21. Tridevi R.K. and P.K. Goal, Introduction to air pollution, Techno Science Publications (TR).
22. Wagner K.D., 1998, Environmental Management, W.B. Saunders co. Philadelphia, USA 499p. 23. Atext book environmental education G.V.S. Publishers byDr. J.P. Yadav

The scheme of the paper will be under: The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.

Exam. Pattern: In case of awarding the marks, the paper will carry 100 marks. Theory: 75 marks, Practical/ Field visit: 25 marks. The structure of the question paper will be:

Part- A: Short Answer Pattern : 15 marks

Part- B: Essay Type with inbuilt choice : 60 marks

Part-C: Field Work (Practical) : 25 marks

Instructions for Examiners :

Part- A: Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.

Part-B: Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

The examination of the regular students will be conducted by the concerned college/Institute. Each student will be required to score minimum 40% marks separately in theory and practical/Field visit. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

| Neural Network Lab | | | | |
|---|---|---|---|---|
| Course code | LC-AI-341G | | | |
| Category | Laboratory Course | | | |
| Course title | Neural Computing Lab | | | |
| Scheme and Credits | L | T | P | Credits |
| | 0 | 0 | 2 | 1 |
| Branches (B. Tech.) | Computer Science and Engineering | | | |
| Class work | 25 Marks | | | |
| Exam | 25 Marks | | | |
| Total | 50 Marks | | | |
| Duration of Exam | 03 Hours | | | |

**NOTE:** Minimum 15 Lab activities / programs related to the course contents of Soft Computing Methods can be designed and developed by the subject faculty using MATLab/Python / any suitable Open Source tools/ software.

Practice of Neural Network tool for : Simple Logic functions , XOR problem, Delta rule, Pattern Classification, Pattern Clustering, Learning Algorithms.

Tentative List of Experiments is-

1. Introduction to Matlab/Python in context with NN.
2. Plotting of Activation Functions: Threshold functions, Signum function, Sigmoid
3. function, Tan-hyperbolic function, Ramp function, Identity function using matlab/Python
4. Implementation of some basic model like MCP with suitable example.
5. Implementation of Hebb model with suitable example.
6. How the weights and bias values affect the output of a neuron.
7. How the choice of activation function (or transfer function) affects the output of a
8. neuron. Experiment with
9. Implementation of linearly separable concept for a problem.
10. To study some basic neuron models and learning algorithms by using Matlab's neural network toolbox or Python's Library.

| Data Visualization Lab | | | | | |
|---|---|---|---|---|---|
| Course code | LC-AIML-371G | | | | |
| Category | Laboratory Course | | | | |
| Course title | Data Visualization Lab | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 0 | 0 | 2 | 1 | |
| Class work | 25 Marks | | | | |
| Exam | 25 Marks | | | | |
| Total | 50 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**NOTE:**

1. Lab programs/activities can be designed and developed by the subject faculty using Python or any suitable Open Source tools/ software.
2. Min 10 Lab activities will be carried out from the offered course contents of Recommender System Course in the semester.
3. Study of various Data Sources

| Recommender Systems Lab | | | | | |
|---|---|---|---|---|---|
| Course code | LC-AIML-373G | | | | |
| Category | Laboratory Course | | | | |
| Course title | Recommender Systems Lab | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 0 | 0 | 2 | 1 | |
| Class work | 25 Marks | | | | |
| Exam | 25 Marks | | | | |
| Total | 50 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**NOTE:**

1. Lab programs/activities can be designed and developed by the subject faculty using Python or any suitable Open Source tools/ software.

2. Min 10 Lab activities will be carried out from the offered course contents of Recommender System Course in the semester.

| PROGRAMMING IN JAVA LAB | | | | | |
|---|---|---|---|---|---|
| Course code | LC-CSE-327G | | | | |
| Category | Professional Core Course | | | | |
| Course title | Java Programming Lab | | | | |
| Scheme and Credits | L | T | P | Credits | Semester 5 |
| | 0 | 0 | 2 | 1 | |
| Classwork | 25Marks | | | | |
| Exam | 25Marks | | | | |
| Total | 50Marks | | | | |
| Duration of Exam | 03Hours | | | | |

**List of Experiments:**

1. Create a java program to implement stack and queue concept.
2. Write a java package to show dynamic polymorphism and interfaces.
3. Write a java program to show multithreaded producer and consumer application.
4. Create a customized exception and also make use of all the5 exception keywords.
5. Convert the content of a given file into the upper case content of the same file.
6. Develop an analog clock using applet.
7. Develop a scientific calculator using swings.
8. Create an editor like MS-word using swings.
9. Create a servlet that uses Cookies to store the number of times a user has visited your servlet.
10. Create a simple java bean having bound and constrained properties.

| PRACTICAL TRAINING 1 | | | | | |
|---|---|---|---|---|---|
| Course code | PT-CSE-329G | | | | |
| Category | Professional Core Course | | | | |
| Course title | PRACTICAL TRAINING 1 | | | | |
| Scheme and Credits | L | T | P | Credits | Semester 5 |
| | 0 | 0 | 2 | 1 | |
| Classwork | - | | | | |
| Exam | - | | | | |
| Total | - | | | | |
| Duration of Exam | - | | | | |

The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.

**Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.**

**SEMESTER-6**

| DATA SCIENCE | | | | | |
|---|---|---|---|---|---|
| Coursecode | PCC-CSE-352G | | | | |
| Category | Professional Core Course | | | | |
| Coursetitle | Data Science | | | | |
| Scheme and Credits | L | T | P | Credits | Semester 6 |
| | 3 | 0 | 0 | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**Objectives of the course:**

11. The objective of this course is to impart necessary knowledge of the basic foundations needed for understanding data science domain and develop programming skills required to build data science applications.
12. To introduce the conceptual knowledge of the area of data science domian, feature and scope of applications.
13. To impart programming knowledge needed for data sciences.
14. To understand the different issues involved in the design and implementation of a data science applications.
15. To understand case studies of essential Data sciences applications.

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**UNIT 1**

**Introduction to Data Science:** Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting, Collection, storing, processing, describing and modelling, statistical modelling and algorithm modelling, AI and data science, Myths of Data science

**UNIT 2**

**Introduction to Programming Tools for Data Science:** Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots, Working with data: Reading Files, Scraping the Web,

## UNIT 3

**Data Science Methodology:** Business Understanding, Analytic Approach, Data Requirements, Data Collection, Data Understanding, data Preparation, Modeling, Evaluation, Deployment, feedback

## UNIT 4

**Data Science Application :** Prediction and elections, Recommendations and buisness analytics, clustering and text analytics

**Suggested Text books:**


1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
2. AurélienGéron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
3. Jain V.K., “Data Sciences”, Khanna Publishing House, Delhi.
4. Jain V.K., “Big Data and Hadoop”, Khanna Publishing House, Delhi.


**Suggested Reference books:**


1. Data Science Workflow: Overview and Challenges by Philip Guo
2. Python for Data Analysis, O’Reilly Media Rajiv, “Machine Learning”, Khanna Publishing House, Delhi.
3. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press
4. http://www.deeplearningbook.org
5. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan
6. Kaufmann Publishers


**Course Outcomes:**

- Understand the value of data science and the process behind using it.
- Use Python to gather, store, clean, analyse, and visualise data-sets.
- Apply toolkits to formulate and test data hypotheses and uncover relationships within data-sets
- Understand the data science methodology in the data science pipeline
- Understand real-world challenges with several case studies

| Introduction to R Programming | | | | |
|---|---|---|---|---|
| Course code | PCC-CSE-354G | | | |
| Category | Professional Core Course | | | |
| Course title | Introduction to R Programming | | | |
| Scheme and Credits | L | T | P | Credits |
| | 3 | 0 | 0 | 3 |
| Class work | 25 Marks | | | |
| Exam | 75 Marks | | | |
| Total | 100 Marks | | | |
| Duration of Exam | 03 Hours | | | |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**COURSE OBJECTIVES:**

1. Develop an R script and execute it
2. Install, load and deploy the required packages, and build new packages for sharing and reusability
3. Extract data from different sources using API and use it for data analysis
4. Visualize and summarize the data

**Unit-I**

R Programming: R interpreter, introduction to R Studio IDE, Introduction to R, Features of R, Advantages and Disadvantages, Why R, Installing, loading and using packages: Read/write data from/in files, R Syntax, Comments, Variables, Data types, Numbers, Arithmetic operations in R, Strings, R Boolean, types of Operators in R

**Unit-II**

Condition or decision making statements in R, Iterative or Loops: While, For, R Functions, Components of Functions, Built in and user defined functions, calling a function, Data preprocessing in R, R packages

## Unit-III

Data Structures in R: Vector, Lists, Matrics, Array, Data Frames, R factors, **Plotting in R**: Data visualization and its importance, Plot, Line, Scatterplot, Pie Charts, Bar, Histograms, Box plot, Normal Distribution, Binary Distribution

## Unit-IV

**R Statics**: Data Set, Min and Max, Mean, Median, Mode, Percentiles, Variance, and Standard Distribution, **Regression analysis in R**: Regression, its types: Linear, Multi, logistic, and Implementation of Regression in R analysis in R, Different evaluation metrics are used in regression.

**Suggested References Books:**


1. R FOR DATA ANALYSIS IN EASY STEPS: R Programming essentials Paperback – 1 January 2017 by Mike Mcgrath (Author)
2. R Programming for Dummies, 2ed Paperback – 1 January 2016 by Andrie de Vries (Author), Joris Meys (Author)
3. Beginner's Guide for Data Analysis using R Programming Paperback – Big Book, 1 January 2018 by Jeeva Jose (Author)


**Course outcomes:**

1. Implementation and solution of real life problem Using R Programiing langguage
2. Visualise the Databasic mathematical concepts in Deep Learning
3. Implementation of Regression for real life problems using R programming language

| Big Data Analytics | | | | | |
|---|---|---|---|---|---|
| Course code | PCC-CSE-356 G | | | | |
| Category | Professional Core Course | | | | |
| Course title | Big Data Analytics | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 3 | 0 | | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course

- To Provide an explanation of the architectural components and programming models used for scalable big data analysis..
- To Identify the frequent data operations required for various types of data and Apply techniques to handle streaming data
- To describe the connections between data management operations and the big data processing patterns needed to utilize them in large-scale analytical applications
- To Identify the type of machine learning problem in order to apply the appropriate set of techniques.
- To be able to apply these techniques to understand the significance of your data sets for your own projects

**Unit: 1**

**Introduction to Big Data:** Big Data: Why and Where, Application and Challenges, Characteristics of Big Data and Dimensions of Scalability, The Six V, Data Science: Getting Value out of Big Data, Steps in the Data science process, Foundations for Big Data Systems and Programming, Distributed file systems

**Unit: 2**

**Introduction to Big Data Modeling and Management:** Data Storage, Data Quality, Data Operations, Data Ingestion, Scalability and Security Traditional DBMS and Big Data Management Systems, Real Life Applications, Data Model: Structure, Operations, Constraints, Types of Big Data Model

**Unit: 3**

**Big Data Integration and processing:** Big Data Processing, Retrieving: Data Query and retrieval, Information Integration, Big Data Processing pipelines, Various operations,
Tools and Systems

**Unit: 4**

**Machine Learning with Big Data**: Ml techniques for Big Data modeling, Overview and Application, Goals and Activites in Machine learning Process, Data Exploration through summary statitics and plots , Data preparation, Classification, regression, Cluster analysis and association analysis

**Suggested books:**

Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

**Suggested reference books**


• Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
• Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
• Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
• Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
• Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
• Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
• Pete Warden, "Big Data Glossary", O'Reily, 2011.
• Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
• ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012

| Organizational Behaviour | | | | | |
|---|---|---|---|---|---|
| Course code | HSMC 02 G | | | | |
| Category | Core Course | | | | |
| Course title | Organizational Behaviour | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 3 | 0 | | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

• Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

**Course Outcomes**

1. For a given query Describe the Big Data landscape including examples of real world big data problems including the three key sources of Big Data: people, organizations, and sensor.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course: The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

UNIT 1

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Difference between management and administration.

UNIT 2

Introduction of organization:-Meaning and process of Organization, Management v/s Organization; Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB. Individual Processes and BehaviorPersonality- Concept, determinants and applications; Perception- Concept, process and applications, Learning- Concept (Brief Introduction) ; Motivation- Concept, techniques and importance.

UNIT 3

Interpersonal Processes- Teams and Groups- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, ConflictConcept, sources, types, management of conflict; Leadership: Concept, function, styles & qualities of leadership. Communication – Meaning, process, channels of communication, importance and barriers of communication.

UNIT 4

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; Organizational culture - Elements, types and factors affecting organizational culture. Organizational change: Concept, types & factors affecting organizational change, Resistance to Change. Suggested

Text books: 1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
7. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications NewDelhi.

Course Outcomes:
By the end of this course the student will be able to:
1. Students will be able to apply the managerial concepts in practical life.
2. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
3. Students will be able to understand the behavioral dynamics in organizations.
4. Students will be able to understand the organizational culture and change

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

- To understand basic concepts of formal languages and automata theory.
- To study the types of Automata i.e. NFA, DFA, NFA with ϵ-transition and their interconversion methods and importance.
- 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.
- To develop the concepts and design of higher-level automata to accept the language not accepted by finite automata such as PDA &Turing machine.
- To study the various properties of turing machine and their designing.

Unit 1:

Finite Automata: Introduction: Set, Power Set, Super Set, Alphabet, languages and grammars, productions and derivation, Deterministic finite automata (DFA), NonDeterministic 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.

| **Formal Languages & Automata** | | | | | |
|---|---|---|---|---|---|
| Course code | PCC-CSE-305G | | | | |
| Category | Core Course | | | | |
| Course title | Formal Languages & Automata | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 3 | 0 | | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

Unit 2:

Regular Expression: State and prove Arden's Method, Regular Expressions, Recursive definition of 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 3:

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 4:

Turing machines: The basic model for Turing machines (TM), Deterministic and NonDeterministic Turing machines and their equivalence, Design of Turing Machines: Transition table, Transition diagram and acceptability of strings by 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.

Suggested 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. Suggested reference books 1. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India. 2. Raymond Greenlaw, H. James Hoover, Fundamentals of the Theory of Computation, Principles and Practice, Morgan Kaufmann, 1998. 3. John C. Martin: Introduction to Languages and Automata Theory, 3rd edition, Tata Mcgraw-Hill, 2007

Course Outcomes:

- To use basic concepts of formal languages of finite automata techniques.
- To Design Finite Automata's for different Regular Expressions and Languages.
- To Construct context free grammar for various languages.
- To solve various problems of applying normal form techniques, push down automata and Turing Machines

| Project-I | | | | | |
|---|---|---|---|---|---|
| Course code | LC-CSE-350G | | | | |
| Category | Laboratory Courses | | | | |
| Course title | Project-I | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 0 | 0 | 4 | 2 | |
| Class work | 25 Marks | | | | |
| Exam | 25 Marks | | | | |
| Total | 50 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**Course Objectives:**

1. To prepare the student to gain major design and or research experience as applicable to the profession
2. Apply knowledge and skills acquired through earlier course work in the chosen project.
3. Make conversant with the codes, standards, application software and equipment
4. Carry out the projects within multiple design constraints
5. Incorporate multidisciplinary components
6. Acquire the skills of comprehensive report writing

**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 project.**

| Data Science Lab | | | | | |
|---|---|---|---|---|---|
| Course code | LC-AIML-370G | | | | |
| Category | Laboratory Course | | | | |
| Course title | Data Science Lab | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 0 | 0 | 2 | 1 | |
| Class work | 25 Marks | | | | |
| Exam | 25 Marks | | | | |
| Total | 50 Marks | | | | |

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 (10 marks).

***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:**

Design a system / process or gain research insight into a defined problem as would be encountered in engineering practice taking into consideration its impact on global, economic, environmental and social context.

| | |
|---|---|
| Duration of Exam | 03 Hours |

**NOTE: Minimum 15 Lab activities / programs related to the course contents of Big Data & Analytics can be designed and developed by the subject faculty using Hadoop Tools/Hadoop Eco System/Python / any suitable Open Source tools/ software.**

| **R Programming Lab** | | | | | |
|---|---|---|---|---|---|
| Course code | LC-AIML-372G | | | | |
| Category | Laboratory Course | | | | |
| Course title | R Programming Lab | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 0 | 0 | 2 | 1 | |
| Class work | 25 Marks | | | | |
| Exam | 25 Marks | | | | |
| Total | 50 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**NOTE: Minimum 15 Lab activities / programs related to the course contents of Introduction to R programming can be designed and developed by the subject faculty using R Studio IDE or R Interpreter**

| Big Data Analytics Lab (Common with CSE in sem 8) | | | | | |
|---|---|---|---|---|---|
| Course code | LC-CSE-364G | | | | |
| Category | Laboratory Course | | | | |
| Course title | R Programming Lab | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 0 | 0 | 2 | 1 | |
| Class work | 25 Marks | | | | |
| Exam | 25 Marks | | | | |
| Total | 50 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**A student has to attempt 12-15 practicals based on theory on an open-source tool.**

| Constitution of India | | | | | |
|---|---|---|---|---|---|
| Course code | MC-317G | | | | |
| Category | Laboratory Course | | | | |
| Course title | Constitution of India | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 2 | 0 | 0 | 0 | |
| Class work | | | | | |
| Exam | | | | | |
| Total | | | | | |
| Duration of Exam | | | | | |

**Course Objectives:**

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals'constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

**Unit-I**

**Philosophy of Indian Constitution:** Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

**Unit-II**

Federal structure and distribution of legislative and financial powers between the Union and the States

## Unit-III

**Organs of Governance:** President – Qualification and Powers of the President, Governor-Qualification and Powers of Governor, Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

## Unit-IV

**Fundamental Rights:** Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Right to equality , Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

**References Books:**

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

**Annexure I**

**Elective –I (Professional Elective Course)**

1. PEC-CSE-311G:Software Engineering
2. PEC-CSE-313G : System Programming and System Administration
3. PEC-CSE-315G :Digital Image Processing

| **Software Engineering** | | | | |
|---|---|---|---|---|
| Course code | PEC-CSE-311G | | | |
| Category | Professional Elective Course | | | |
| Course title | Software Engineering | | | |
| Scheme and Credits | L | T | P | Credits |
| | 3 | 0 | 0 | 3 |
| Class work | 25 Marks | | | |
| Exam | 75 Marks | | | |
| Total | 100 Marks | | | |
| Duration of Exam | 03 Hours | | | |

**Objectives of the course**

Be successful professionals in the field with solid fundamental knowledge of software engineering

Utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multidisciplinary teams

Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: The process, software products, emergence of software engineering, evolving role of software, software life cycle models, Software Characteristics, Applications, Software crisis. Software project management: Project management concepts, software process and project metrics Project planning, project size estimation metrics, project estimation Techniques, empirical estimation techniques, COCOMO-A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management, project scheduling and tracking

Unit: 2

Requirements Analysis and specification requirements engineering, system modeling and simulation Analysis principles modeling, partitioning Software, prototyping: , Prototyping methods and tools; Specification principles, Representation, the software requirements specification and reviews Analysis 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 control and process specification; The data dictionary; Other classical analysis methods. System Design: Design concepts and principles: the design process: Design and software quality, design principles; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling;

Unit: 3

Architectural Design: Software architecture, Data Design: Data modeling, data structures, databases and the data warehouse, Analyzing alternative Architectural Designs, architectural complexity; Mapping requirements into a software architecture; Transform flow, Transaction flow; Transform mapping: Refining the architectural design. Testing and maintenance: Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, white box testing, basis path testing: Control structure testing: Black box testing, testing for specialized environments, architectures and applications. Software Testing Strategies: Verification and validation, Unit testing, Integration testing, Validation testing, alpha and beta testing; System testing: Recovery testing, security testing, stress testing, performance testing; The art of debugging, the debugging process debugging approaches. Software re-engineering, reverse engineering, restructuring, forward engineering.

Unit: 4

Software Reliability and Quality Assurance :Quality concepts, Software quality assurance , SQA activities; Software reviews: cost impact of software defects, defect amplification and removal; formal technical reviews: The review meeting, review reporting and record keeping, review guidelines; Formal approaches to SQA; Statistical software quality assurance; software reliability: Measures of reliability and availability ,The ISO 9000 Quality standards: The ISO approach to quality assurance systems, The ISO 9001 standard, Software Configuration Management. Computer Aided software Engineering: CASE, building blocks, integrated case environments and architecture, repository.

**Suggested books**: Software Engineering – A Practitioner's Approach, Roger S. Pressman, 1996, MGH. Suggested reference books Fundamentals of software Engineering, Rajib Mall, PHI Software Engineering by Nasib Singh Gill, Khanna Book Publishing Co (p) Ltd Software Engineering by Ian Somerville, Pearson Edu, 5 edition, 1999, AW, Software Engineering – David Gustafson, 2002, T.M.H Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson 1995 JW&S, An Integrated Approach to software engineering by Pankaj jalote , 1991 Narosa,

**Course Outcomes** 1. How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment 2. An ability to work in one or more significant application domains 3. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software 4. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle 5. Demonstrate an ability to use the techniques and tools necessary for engineering practice

| SYSTEM PROGAMMING AND SYSTEM ADMINISTRATION | | | | | |
|---|---|---|---|---|---|
| Course code | PEC-CSE-313G | | | | |
| Category | SYSTEM PROGAMMING AND SYSTEM ADMINISTRATION | | | | |
| Course title | Software Engineering | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 3 | 0 | 0 | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

**Objectives of the course** 1. Evolution of the components of system programming. 2. To learn working and different stages of compilation process. 3. To learn basic of assembler and loading schemes. 4. To learn basics of file structure. 5. To know about filters and pipeline. 6. To learn shell programming

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Evolution of Components Systems Programming, Assemblers, Loaders, Linkers, Macros, Compilers. software tools, Text editors, Interpreters and program generators, Debug Monitors, Programming environment. Compiler: Brief overview of compilation process, Incremental compiler, Assembler: Problem statement, symbol table; Loader schemes, compile and go Loader, general loader schemes, absolute loader, Reallocating loader, Direct linkage Loader, Binders, overlays.

Unit: 2

Theoretical Concept of Unix Operating System: Basic features of operating system; File structure: CPU scheduling; Memory management: swapping, demand paging; file system: block and fragments, inodes, directory structure; User to user communication

Unit: 3

Getting Started with Unix: User names and groups, logging in; Format of Unix commands; Changing your password; Characters with special meaning; Unix documentation; Files and directories; Current directory, looking at the directory contents, absolute and relative pathnames, some Unix directories and files; Looking at the file contents; File permissions; basic operation on files; changing permission modes; Standard files, standard output; Standard input, standard error; filters and pipelines; Processes; finding out about processes; Stopping background process; Unix editor vi.

Unit-4

Shell Programming: Programming in the Borne and C-Shell; Wild cards; Simple shell programs; Shell variables; interactive shell scripts; Advanced features. System Administration: Definition of system administration; Booting the system; Maintaining user accounts; File systems and special files; Backups and restoration; Role and functions of a system manager. Overview of the Linux operating system

Suggested books: 1. Systems Programming by Donovan, TMH. 2. The unix programming environment by Brain Kernighen& Rob Pike, 1984, PHI & Rob Pike. 3. Design of the Unix operating system by Maurich Bach, 1986, PHI. 4. Introduction to UNIX and LINUX by John Muster, 2003, TMH.

Suggested reference books 1. Advanced Unix programmer's Guide by Stephen Prato, BPB 2. Unix-Concept and applications by Sumitabha Das, 2002, T.M..H

Course Outcomes 1. To understand various file statistics. 2. To work on wildcards. 3. To know about shell programming and AWK utility.

| **Digital Image Processing** | | | | |
|---|---|---|---|---|
| Course code | PEC-CSE-315G | | | |
| Category | Professional Elective Course | | | |
| Course title | Digital Image Processing | | | |
| Scheme and Credits | L | T | P | Credits |
| | 3 | 0 | 0 | 3 |
| Class work | 25 Marks | | | |
| Exam | 75 Marks | | | |
| Total | 100 Marks | | | |
| Duration of Exam | 03 Hours | | | |

**Objectives of the course**

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.

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

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

Unit: 2

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models, Pseudo colouring, colour transforms, Basics of Wavelet Transforms. Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering

Unit: 3

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

Unit-4

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors.

Suggested 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.

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

Course Outcomes 1. Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms. 2. Operate on images using the techniques of smoothing, sharpening and enhancement. 3. Understand the restoration concepts and filtering techniques. 4. Learn the basics of segmentation, features extraction, compression and recognition methods for colour models

**Elective –II (Professional Elective Course)**

1. PEC-CSE-310G: Advanced Database Management System
2. PEC-CSE-315G : Digital Image Processing
3. PCC-CSE-302G : Compiler Design
4. PEC-DS-314G: NoSQL Database
5. PEC-DS-316G: UX/UI Design

| **Advanced Database Management System** | | | | |
|---|---|---|---|---|
| Course code | PEC-CSE-310G | | | |
| Category | Professional Elective Course | | | |
| Course title | Advanced Database Management System | | | |
| Scheme and Credits | L | T | P | Credits |
| | 3 | 0 | 0 | 3 |
| Class work | 25 Marks | | | |
| Exam | 75 Marks | | | |
| Total | 100 Marks | | | |
| Duration of Exam | 03 Hours | | | |

**Objectives of the course**

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

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

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 2

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, Multiversion techniques, Deadlocks.

UNIT 3

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 4

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

Suggested Text Book: 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

Suggested References Books: 1. Date, Kannan, Swaminathan, “An Introduction to Database Systems”, 8th Edition Pearson Education, 2007 2. Singh S.K., “Database System Concepts, design and application”, Pearson Education, 2006. 3. Silberscatz, Korth, Sudarshan, “Database System Concepts”, Mcgraw Hill, 6th Edition, 2006 4. W. Kim, “Modern Database Systems”, 1995, ACM Press, Addision Wesley,

Course Outcomes: Students will get understanding of DBMS Components, Its advantages and disadvantages. Understanding about various types of Data modeling: ER, EER, Network, Hierarchical and Relational data models. Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization. Understanding transaction concept, schedules, serializability, locking and concurrency control protocols

| **COMPILER DESIGN** | | | | |
|---|---|---|---|---|
| Course code | PEC-CSE-302G | | | |
| Category | Professional Elective Course | | | |
| Course title | COMPILER DESIGN | | | |
| Scheme and Credits | L | T | P | Credits |
| | 3 | 0 | 0 | 3 |
| Class work | 25 Marks | | | |
| Exam | 75 Marks | | | |
| Total | 100 Marks | | | |

| | |
|---|---|
| Duration of Exam | 03 Hours |

Objectives of the course

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.

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

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 number of states of DFA, Implementation of lexical analyzer.

UNIT 2

Syntax Analysis: Role of parsers, context free grammars. Parsing Technique: Shift-reduce parsing, Operator precedence parsing, Top down parsing, Predictive parsing.

UNIT 3

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 4

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

Suggested Text Books: 1. Compilers Principle, Techniques & Tools - Alfread V. AHO, Ravi Sethi & J.D. Ullman; 1998 Addison Wesley.

Suggested Reference Books: 1. Theory and practice of compiler writing, Tremblay & Sorenson, 1985, Mc. Graw Hill. 2. System software by Dhamdere, 1986, MGH. 3. Principles of compiler Design, Narosa Publication 4. Elements compiler Design, Dr. M. Joseph, University Science Press

Course Outcomes: 1. To develop the lexical analyser for a given grammar specification. 2. For a given parser specification design top-down and bottom-up parsers. 3. To Develop syntax directed translation schemes.

| NOSQL Databases | | | | | |
|---|---|---|---|---|---|
| Course code | PEC-DS-314G | | | | |
| Category | Professional Elective Course | | | | |
| Course title | NOSQL Databases | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 3 | 0 | 0 | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:
The objective of this course are:

1. Explore the origins of NoSQL databases and the characteristics that distinguish them from traditional relational database management systems.
2. Understand the architectures and common features of the main types of NoSQL databases (key-value stores, document databases, column-family stores, graph databases)
3. Discuss the criteria that decision makers should consider when choosing between relational and non-relational databases and techniques for selecting the NoSQL database that best addresses specific use cases.

## Unit-I

INTRODUCTION TO NOSQL CONCEPTS: Data base revolutions: First generation, second generation, third generation, Managing Trans- actions and Data Integrity, ACID and BASE for reliable database transactions, Speeding performance by strategic use of RAM, SSD, and disk, Achieving horizontal scalability with Data base sharding, Brewers CAP theorem.

NOSQL DATA ARCHITECTURE PATTERNS : NoSQL Data model: Aggregate Models- Document Data Model- Key-Value Data Model- Columnar Data Model, Graph Based Data Model Graph Data Model, NoSQL system ways to handle big data problems, Moving Queries to data, not data to the query, hash rings to distribute the data on clusters, replication to scale reads, Database distributed queries to Data nodes.

Unit-II

KEY VALUE DATA STORES : From array to key value databases, Essential features of key value Databases, Properties of keys, Characteristics of Values, Key-Value Database Data Modeling Terms, Key-Value Architecture and implementation Terms, Designing Structured Values, Limitations of Key-Value Databases, Design Patterns for Key-Value Databases, Case Study: Key-Value Databases for Mobile Application Configuration.

DOCUMENT ORIENTED DATABASE: Document, Collection, Naming, CRUD operation, querying, indexing, Replication, Sharding Consistency Implementation: Distributed consistency, Eventual Consistency, Capped Collection, Case studies: document oriented database: Mongo DB and/or Cassandra

Unit-III

COLUMNAR DATA MODEL – I: Data warehousing schemas: Comparison of columnar and row-oriented storage, Column-store Architectures: C-Store and Vector-Wise, Column-store internals and, Inserts/updates/deletes, Indexing, Adaptive Indexing and Database Cracking.

COLUMNAR DATA MODEL – II : Advanced techniques: Vectorized Processing, Compression, Write penalty, Operating Directly on Compressed Data Late Materialization Joins , Group-by, Aggregation and Arithmetic Operations, Case Studies

Unit-IV

DATA MODELING WITH GRAPH : Comparison of Relational and Graph Modeling, Property Graph Model Graph Analytics: Link analysis algorithm- Web as a graph, Page Rank- Markov chain, page rank computation, Topic specific page rank (Page Ranking Computation techniques: iterative processing, Random walk distribution Querying Graphs: Introduction to Cypher, case study: Building a Graph Database Application- community detection. Recent trends in Databases/Next Generation Databases and Contemporary Issues.

References Books:

1. Christopher D.manning, Prabhakar Raghavan, Hinrich Schutze, An introduction to Information Retrieval, Cambridge University Press
2. Daniel Abadi, Peter Boncz and Stavros Harizopoulas, The Design and Implementation of Modern Column-Oriented Database Systems, Now Publishers.
3. Guy Harrison, Next Generation Database: NoSQL and big data, Apress.

Course Outcomes:
After successfully completing the course the student should be able to
1. Explain the detailed architecture, Database properties and storage requirements
2. Differentiate and identify right database models for real time applicationsOutline Key value architecture and characteristics
3. Design Schema and implement CRUD operations, distributed data operations
4. Compare data ware housing schemas and implement various column store internals
5. Choose and implement Advanced columnar data model functions for the real time applications
6. Develop Application with Graph Data model

| UI/UX Design | | | | | |
|---|---|---|---|---|---|
| Course code | PEC-DS-316G | | | | |
| Category | Programme Elective Course | | | | |
| Course title | UI/UX Design | | | | |
| Scheme and Credits | L | T | P | Credits | |
| | 3 | 0 | 0 | 3 | |
| Class work | 25 Marks | | | | |
| Exam | 75 Marks | | | | |
| Total | 100 Marks | | | | |
| Duration of Exam | 03 Hours | | | | |

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:
The objective of this course are:
1. Understand the concepts of design; Utilize by learning various color models
2. Gain knowledge on the basics of various law in UX
3. Construct the task for requirement gathering
4. Gain knowledge on how to Design for various domains or applications

5. Introduce tools for designing various applications
6. Utilise different types of design for real-time programming applications

## Unit-I

What is typography-type properties, baseline, cap height, X-height, ascenders, Descenders and weight,

Type classification-Serif ,sans serif fonts, monospace, handwriting and Display, Readability, letter spacing, line height with an example, Paragraph spacing, power of alignment, Leading and Kerning, Fundamentals of color, Color Models Introduction, RGB, CMYK, Color harmony: monochromatic, analogous, Complementary, triadic, double-complementary, Meaning of colors, The power of Contrast

## Unit-II

Laws of UX designing , Hicks law, example of hicks law with an application Jakob‘s law, example of jakob‘s law with an application, Fitts‘s Law, example of Fitts‘s law with an application, Ockham‘s Razor , example of Ockham‘s law with an application, Pareto Principle, example of Pareto principle with an application, Weber‘s law, example of Weber‘s law with an application, Tesler‘s law, example of Tesler‘s law with an application, Law of proximity, example of proximity, Law of similarity and human eye

## Unit-III

Introduction to Interaction Design , Task analysis, Data collection for gathering user , Data for task requirements, Requirements gathering, Eliciting Qualitative data, analyzing qualitative data, Qualitative metrics, User narratives, Scenario implementation and its challenges, Wireframes, Example on wireframes.

Prototypes : Introduction, Implementation of Prototypes, UX design for mobile application, Application design example , Responsive Design, Adaptive design and difference with Responsive design. Culture in usability, Universal usability, Inclusive interaction, Importance of accessibility, principles of accessibility, Universal design, Accessibility design, Font weight, color, Contrast, Screen readers, Alt text using a tool

## Unit-IV

Introduction to Multifaceted Users, Designing for Multifaceted Users, Design guidelines, Guidelines for helping adults, Application example, Virtual third eye simulator introduction, Web accessibility guide, Virtual third eye simulator web accessibility.

Importance of case studies and guidelines: Tracking APP Introduction, Tracking APP Design guidelines, Tracking APP demo, Designing UI, Redesigning Gmail and making it flash, Design principles, Redesigning Gmail and making it flash Demo.

Introduction of how to Design a new UX concept to reduce driver distraction, Designing concepts of Driver distraction Demo, Importance of User data in UX designing, Approach to design without user data,

Designing concept , Implementation problems without data, Dynamic webpages, Demo, Perform UI Case study

Reference Books:

1. Jeff Johnson, Kate Finn, Designing user Interfaces for an aging population towards Universal design, Morgan Kauffman publishers, Elseiver-2017
2. Elvis Canziba, Hands-on UX Design for Developers, Packt Birminiham,mumbai-2018
3. Andrew Rogerson, User Experience Design, Smashin media 2012, Freiburg,Germany
4. Barbara Ballard, Designing the mobile user experience, Wiley publications, 2007
5. https://uxdesign.cc/tagged/case-study

Course Outcomes:

After successfully completing the course the student should be able to

1. Identify various color models for design
2. Create the design as per the design law
3. Construct the task for requirement gathering
4. Create wire frames and prototypes
5. Create the usability constraints and accessibility
6. Construct real-time applications using real -time programming applications

**Elective –III (Professional Elective Course)**

1. PEC-CSE-316G: Distributed System
2. PEC-CSE-332G : VHDL and Digital Design
3. PEC-DS-312G: Business Intelligence and Analytics
4. PEC-DS-405G: Advanced Python Programming
5. PCC-AI-403G : Applied Machine Learning

| Distributed System | | | | |
|---|---|---|---|---|
| Course code | PEC-CSE-316G | | | |
| Category | Programme Elective Course | | | |
| Course title | Distributed System | | | |
| Scheme and Credits | L | T | P | Credits |
| | 3 | 0 | 0 | 3 |
| Class work | 25 Marks | | | |
| Exam | 75 Marks | | | |
| Total | 100 Marks | | | |
| Duration of Exam | 03 Hours | | | |

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

- To examine the fundamental principles of distributed systems, and provide students hands-on experience in developing distributed protocols.

- 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 1

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 2

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 3

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 4

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

Suggested 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

Course Outcomes: List the principles of distributed systems and describe the problems and challenges associated with these principles. Understand Distributed Computing techniques, Synchronous and Processes. Apply Shared Data access and Files concepts. Design distributed system that fulfills requirements with regards to key distributed systems properties. Understand Distributed File Systems and Distributed Shared

Memory. Apply Distributed web-based system and understand the importance of security in distributed system

| VHDL AND DIGITAL DESIGN | | | | |
|---|---|---|---|---|
| Course code | PEC-CSE-332G (common with ECE) | | | |
| Category | Programme Elective Course | | | |
| Course title | VHDL AND DIGITAL DESIGN | | | |
| Scheme and Credits | L | T | P | Credits |
| | 3 | 0 | 0 | 3 |
| Class work | 25 Marks | | | |
| Exam | 75 Marks | | | |
| Total | 100 Marks | | | |
| Duration of Exam | 03 Hours | | | |

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

- To understand the modelling & simulation & its role in digital evaluation.
- To learn basic concepts of VHDL language, its different architecture, designing of various Combinational & sequential circuits.
- To study various PLDs & detail study of FPGAs and implementation of various combinational & sequential logic circuits on FPGAs.

UNIT-1

INTRODUCTION: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical

operators. Types of delays, Entity and Architecture declaration. Introduction to behavioural dataflow and structural models.

UNIT- 2

VHDL STATEMENTS: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

UNIT -3

COMBINATIONAL & SEQUENTIAL CIRCUIT DESIGN:VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

UNIT-4

DESIGN OF MICROCOMPUTER & PROGRAMMABLE DEVICE: Basic components of a computer, specifications, architecture of a simple microcomputer system, and implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

REFERENCE BOOKS: 1. Ashenden - Digital design,Elsevier 2. IEEE Standard VHDL Language Reference Manual (1993). 3. Digital Design and Modelling with VHDL and Synthesis: KC Chang; IEEE Computer Society Press. 4. "A VHDL Primmer" : Bhasker; Prentice Hall 1995. 5. "Digital System Design using VHDL" : Charles. H.Roth ; PWS (1998). 6. "VHDL-Analysis & Modelling of Digital Systems" :Navabi Z; McGraw Hill. 7. VHDL-IV Edition: Perry; TMH (2002) 8. "Introduction to Digital Systems" :Ercegovac. Lang & Moreno; John Wiley (1999). 9. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH (2000) 10. Modern Digital Electronics- III Edition: R.P Jain; TMH (2003). 11. Grout - Digital system Design using FPGA & CPLD 'S,Elsevier

Course Outcome: After the completion of the course the student will be able to: Understand the need & application of hardware description language. Modelling & simulations of various basic & advanced digital systems using VHDL. Implementation of various basic & advanced digital systems using FPGAs. Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications

| Business Intelligence & Analytics | | | | |
|---|---|---|---|---|
| Course code | PEC-DS-312G | | | |
| Category | Professional Electives Course | | | |
| Course title | Business Intelligence & Analytics | | | |
| Scheme and Credits | L | T | P | Credits |
| | 3 | 0 | 0 | 3 |
| Class work | 25 Marks | | | |
| Exam | 75 Marks | | | |
| Total | 100 Marks | | | |
| Duration of Exam | 03 Hours | | | |

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

1. Introduce the Business intelligence concepts ,techniques and models
2. Understand the modeling process behind business analytics
3. To analyze different data analysis tools and techniques

Unit-I

Introduction: Introduction to Business Intelligence – Designing Business Intelligence Application- Requirements Gathering, Establishing the Technical Architecture, Designing a Business Intelligence Solution , Designing Dimensional Models , Designing the Physical Databases ;

Predictive Analytics: Data Mining Concepts- Definitions, Characteristics, and Benefits - How Data Mining Works - Data Mining Versus Statistics Data Mining Process - Data Mining Methods - Data Mining and Privacy Issues - Regression – Classification –Association Rules – clustering -Techniques for Predictive Modeling – ANN- SVM

Unit-II

Text Analytics, Text Mining, And Sentiment Analysis: Text Analytics, Text Mining, and Sentiment Analysis - Natural Language Processing - Text Mining Process- tools - Sentiment Analysis -Overview, Process, Applications - Speech Analytics – Rule based, Multi, Layer, Hybrid Sentimental analysis – Machine Learning in Sentimental analysis

Web Analytics and Web Mining : Web Mining Overview - Web Content and Web Structure Mining - Search Engines - Search Engine Optimization - Web Analytics Technologies, metrics - Web Analytics Maturity Model and Web Analytics Tools

Unit-III

Prescriptive Analytics: Decision Support Systems Modeling - Mathematical Models for Decision Support - Certainty, Uncertainty, and Risk- Decision Modeling with Spreadsheets - Mathematical Programming Optimization, - Decision Analysis with Decision Tables and Decision Trees - Problem-Solving Search Methods - Problem-Solving Search Methods

Unit-IV

Knowledge Management and Big Data Analytics : Knowledge Management –Concepts, Definitions , Approaches, tools and techniques - Big Data and Analytics- Fundamentals of Big Data Analytics – Technologies - Data Scientist - Big Data and Data Warehousing - Automated Decision Systems and Expert Systems - Business Analytics: Emerging Trends and Future Impacts, Recent Trends and contemporary issues.

Reference Books:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, “Business Intelligence and Analytics”, 10th Edition, Pearson , 2015.
2. S. Christian Albright, Wayne L. Winston, Business Analytics: Data Analysis & Decision Making, 6th Edition, CENGAGE INDIA , 2017
3. Dinabandhu Bag, Business Analytics, Routledge, 1st edition, 2016
4. Rick Sherman, Business Intelligence Guidebook: From Data Integration to Analytics, Morgan Kaufmann, 1st edition 2014

Course Outcomes:

After successfully completing the course the student should be able to

1. Understand the fundamental of Business Intelligence and to design a customized solution.

2. Familiarize on the concepts, techniques and reporting methods of descriptive analytics and predictive analytics
3. Explore the methods used to analyze speech and text and implement optimized search engines
4. Design and implement Decision Support systems
5. Familiarize on the processes needed to develop, report, and analyze business data.

| Advanced Python Programming | | | | |
|---|---|---|---|---|
| Course code | PEC-DS-405G | | | |
| Category | Professional Elective Course | | | |
| Course title | Advanced Python Programming | | | |
| Scheme and Credits | L | T | P | Credits |
| | 3 | 0 | 0 | 3 |
| Class work | 25 Marks | | | |
| Exam | 75 Marks | | | |
| Total | 100 Marks | | | |
| Duration of Exam | 03 Hours | | | |

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

The objective of this course are:

1. To be able to apply advanced python programming concepts for industry standard problems.
2. To perform advanced Data Preprocessing tasks like Data Merging and Mugging
3. To be able to develop powerful Web-Apps using Python

## Unit-I

Data Structures: Problem solving using Python Data Structures : LIST, DICT, TUPLES and SET- Functions and Exceptions – Lamda Functions and Parallel processing – MAPS – Filtering - Itertools – Generators.

Classes & Objects: Classes as User Defined Data Type ,Objects as Instances of Classes, Creating Class and Objects, Creating Objects By Passing Values, Variables & Methods in a Class Data , Abstraction, Data Hiding, Encapsulation, Modularity, Inheritance, Polymorphism

Unit-II

Python Multithreading: Python Multithreading and Multiprocessing Multithreading and multiprocessing Basics – Threading module and example – Python multithreading - Multithreaded Priority Queue.

Data Processing: Handling CSV, Excel and JSON data - Creating NumPy arrays, Indexing and slicing in NumPy, Downloading and parsing data, Creating multidimensional arrays, NumPy Data types, Array Attribute, Indexing and Slicing, Creating array views copies, Manipulating array shapes I/O – MATPLOT LIB

Unit-III

Data Science Perspectives: Using multilevel series, Series and Data Frames, Grouping, aggregating, Merge Data Frames, Generate summary tables, Group data into logical pieces, Manipulate dates, Creating metrics for analysis.

Data Handling Techniques: Data wrangling, Merging and joining, - Loan Prediction Problem, Data Mugging using Pandas

Unit-IV

Web Applications: Web Applications With Python – Django / Flask / Web2Py – Database Programming – NoSQL databases - Embedded Application using IOT Devices - Building a Predictive Model for IOT and Web programming; Recent Trends and Contemporary issues.

References Books:

1. Doug Farrell, The Well Grounded Python Developer; Manning Publications, 2021
2. Paul Barry, Head-First Python, O-Reilly Media, 2016
3. Zed A Shaw, Learn Python the Hard Way - A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code, Addison Wesley Press, 2013
4. Eric Mathews, Python Crash Course, Second Edition, No Starch Press, 2019
5. Michael Kennedy, Talk Python: Building Data-Driven Web Apps with Flask and SQLAlchemy, Manning Publications, 2020

Course Outcomes:
After successfully completing the course the student should be able to

1. Understand the nuances of Data Structures
2. Derive an understanding of a classes and objects and their potential

3. Gain knowledge of multithreading concepts and implementing the same
4. Appreciate the difference between different data processing techniques
5. Learn to apply Python features for Data Science
6. Get an insight into Metrics Analysis
7. Develop web-apps and build models for IoT

| Applied Machine Learning | | | | |
|---|---|---|---|---|
| Course code | PCC-AI-403G | | | |
| Category | Professional Core Course | | | |
| Course title | Applied Machine Learning | | | |
| Scheme and Credits | L | T | P | Credits |
| | 3 | 0 | 0 | 3 |
| Class work | 25 Marks | | | |
| Exam | 75 Marks | | | |
| Total | 100 Marks | | | |
| Duration of Exam | 03 Hours | | | |

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

The objective of this course are:

1. Analyze the text data using Machine Learning
2. Analyze the audio data using Machine Learning
3. Analyze Time series and Sequential data using Machine Learning
4. Analyze the Image Content using Machine Learning
5. Visualize the data

Unit-I

Text Feature Engineering-Introduction, Cleaning text data, Preprocessing data using, tokenization , tagging and categorising words, Sequential tagging, Backoff tagging, Creating features from text data-

Stemming, Lemmatising, Bagging using random forests, Implementing bag of words, Testing prepared data Analyze the results, Building a text classifier, Analyzing the sentiment of a sentence, Implement the sentiment analysis of a sentence, Identifying patterns in text using topic modeling, Implement identifying patterns in text using topic modeling, Case study- Twitter Data ;

Speech Recognition- Introduction, Reading audio data, Plotting audio data, Transforming audio signals into the frequency domain, Apply Fourier transform signal and plot, Generating audio signals with custom parameters, Generate the time axis,

## Unit-II

Speech Recognition- Synthesizing music, Construct the audio sample -amplitude and frequency, synthesizer function, Extracting frequency domain features, MFCC and filter bank features, Building Hidden Markov Models, HMM training and prediction, Building a speech recognizer, MFCC features, Case study.

Dissecting Time Series and Sequential Data – Introduction, Transforming data into the time series format, Pandas and Numpy to convert Time Series data, Plotting time series data, Slicing time series data, Operating on time series data, Plotting sliced time series data, Operating on time series data, Extracting statistics from time series data, Correlation coefficients, Plotting and understanding correlations, Building Hidden Markov Models for sequential data, Prepare the Time Series data, Train Gaussian HMM, Visualizing the model, Building Conditional Random Fields for sequential text data, CRF Model, Analyzing stock market data using, Hidden Markov Models, Train the HMM and visualize

## Unit-III

Image Content Analysis, Computer Vision, Operating on images using OpenCV- Python, Learn to extract and load the image, Detecting edges, Histogram equalization, Sobel filter, Laplacian edge detector, Canny edge detector, Histogram equalization, Visualize gray scale image, Detecting corners, Understand the output corner detection image, Detecting SIFT feature points, SIFT feature detection, Visualize the feature detected image, Building a Star feature detector, Detect features using the Star feature detector, Visualize keypoints on the input image, Creating features using visual codebook and vector quantization, Method to quantize the data points

## Unit-IV

Biometric Face Recognition - Face detection from the image and video, Capturing and processing video from a webcam, Resizing and Scaling, Building a face detector using Haar cascades , determine the location of a face in the video frames captured from the webcam, Face detector on the grayscale image, Building eye and nose detectors, Face cascade classifier, Visualize eye and nose detector , Performing Principal Components Analysis, PCA in face recognition systems, Convert the dataset from a five- dimensional set to a two-dimensional set , Kernel Principal Components Analysis , Plot Kernel PCA-transformed data, Performing

blind source separation, Independent Components Analysis, Perform Kernel PCA, Plot the PCA-transformed data

References Books:

1. Prateek Joshiandco, Python: Real World Machine Learning, Packt Publishing, 2016
2. Sebastian Raschka, Python Machine Learning, Packt Publishing, 2013.
3. Richert Coelho, Building Machine Learning Systems with Python, Packt Publishing,2016
4. Michael Bowles, Machine Learning in Python, Wiley & Sons, 2015

Course Outcomes:

After successfully completing the course the student should be able to

1. Identifying patterns in text using topic modeling
2. Building a speech recognizer
3. Extracting statistics from time series data,
4. Building Conditional Random Fields for sequential text data
5. Building an object recognizer