V-SEMESTER

Scheme of Instruction & Examination

B. E. – Artificial Intelligence and Data Science

AI&DS Semester - V

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P/D	Contact Hours/week	CIE	SEE	
		Theory Courses							
1	1PC508AD	Design and Analysis of Algorithms	3	1	0	4	40	60	4
2	1PC509AD	Data Science	3	0	0	3	40	60	3
3	1ES501CS	Digital Image Processing	3	0	0	3	40	60	3
4	1PE5(01 to 05) AD	Professional Elective – I	3	0	0	3	40	60	3
5	OE	Open Elective – I	3	0	0	3	40	60	3
6	1MC503HS	Indian Constitution	3	0	0	3	40	60	0
		Practical / Laboratory Courses							
7	1PC559AD	Data Science Lab	0	0	2	2	40	60	1
8	1ES551CS	Digital Image Processing Lab	0	0	2	2	40	60	1
9	1HS553HS	Soft Skills Lab-I	0	0	2	2	40	60	1
10	1PW560AD	Skill Development Course - III	0	0	2	2	40	60	1
		Total Credits				25	400	600	20

Professional Elective - I

1	1PE501AD	Mobile Computing
2	1PE502AD	Data Mining
3	1PE503AD	Software requirements and Estimation
4	1PE504AD	Principles of Programming Languages
5	1PE505AD	Advanced Databases

Open Elective - I

1OE50XXX	Open Elective - I	Offered by
1	Disaster Mitigation	CIVIL
2	Oops using JAVA	CSE
3	Artificial Intelligence	AI&DS
4	Renewable Energy Systems	EEE
5	Basics of Electronic Communication	ECE
6	Energy Science and Engineering	MECH

Course Code	Course Title						Core/Elective
1PC508AD	DESIGN AND ANALYSIS OF ALGORITHMS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	1	-	-	40	60	4

COURSE OBJECTIVES :

The objective of this course is to make the student to

1. Analyze the asymptotic performance of algorithms and correctness proofs for algorithms
2. Demonstrate a familiarity with major algorithms and data structures
3. Apply important algorithmic design paradigms and methods of analysis
4. Familiarizing students with specific algorithms for a number of important computational problems like sorting, searching, and graphs, etc,
5. Introducing the concept of NP-complete problems and different techniques to deal with them

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the basic notation for analyzing the performance of the algorithms.
2. Use divide-and-conquer techniques for solving suitable problems
3. Use greedy approach to solve an appropriate problem for optimal solution.
4. Apply dynamic programming approach to solve suitable problems
5. Understand the limitations of algorithm power and study how to cope with the limitations of algorithm power for various problems

UNIT - I

Introduction & Elementary Data Structures: Introduction, Fundamentals of algorithm (Line Count, Operation Count), Analysis of algorithms (Best, Average, Worst case), Asymptotic Notations (O, Ω, Θ) Recursive Algorithms, Analysis using Recurrence Relations, Master's Theorem.

Review of elementary data structures–Graphs: BFS, DFS, Articulation points, Bi-Connected Components. Sets: representation, UNION, FIND operations.

UNIT - II

Divide-and-Conquer Method : The general method, Binary search, Finding maximum and minimum, Merge sort, Quick sort.

Brute Force : Knapsack, Travelling salesman problem, Convex-Hull.

UNIT - III

Greedy Method : Knapsack problem, Minimum spanning trees, Single source shortest path, Job sequencing with deadlines, Optimal storage on tapes, Optimal merge pattern.

Dynamic programming method : All pairs shortest paths, Optimal binary search tress, 0/1 Knapsack problem, Reliability design, Travelling salesman problem.

UNIT - IV

Back tracking : N-queens problem, Graph coloring , Hamiltonian cycles

Branch-and-bound : FIFO & LC branch and Bound methods, 0/1 Knapsack problem, Travelling sales person.

UNIT - V

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem, Proofs for NP Complete Problems: Clique, Vertex Cover.

TEXT BOOKS

1. Fundamentals of Computer Algorithms, Horowitz E, Sahni S, IIEdition,Universities Press, 2007,

2. "Introduction to Algorithms", Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and CliffordStein, III Edition , PHI Learning Private Limited, 2012.

REFERENCE BOOKS

1. Algorithm Design : Foundations, Analysis and Internet Examples, Michael T. Goodrich, Roberto Tamassia, I Edition, John Wiley & Sons, 2002.

2. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, II Edition, Pearson education.

Course Code	Course Title				Core/Elective
1PC509AD	DATA SCIENCE				Core
Prerequisite	Contact Hours per Week			CIE	SEE	Credits

Prerequisite	L	T	D	P	CIE	SEE	Credits
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Learn fundamental knowledge on basics of data science and R programming
2. Learn basics of R Programming environment: R language, R- studio and R packages.
3. Understand various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting.
4. Learn fundamentals of how to obtain, store, explore, and model data efficiently.
5. Understand the concepts of classification and clustering.

COURSE OUTCOMES :

After the completion of course the students will be able to:

1. Recognize the different levels of Data Science concepts for visualization of data.
2. Demonstrate the data visualization and statistical techniques, for describing data structure property.
3. Analyze the basics of probability and statistics models for data exploration
4. Make use of Hypothesis testing for statistical analytics for destroying target based on the mission requirements.
5. Demonstrate numerous open source data science tools to solve real-world problems through industrial case studies.

UNIT - I

Data Science : Introduction to data science, Data Science process, Need for Data Science, Linear Algebra for data science, Linear equations, Distance, Eigen values, Eigenvectors.

UNIT-II

Descriptive statistics, data preparation. Exploratory Data Analysis data summarization, data distribution, measuring asymmetry. Sample and estimated mean, variance and standard score. Statistical Inference frequency approach, variability of estimates, hypothesis testing using confidence intervals, using p-values.

UNIT- III

Introduction to R Programming, getting started with R : Installation of R software and using the interface, Variables and data types, R Objects, Vectors and lists, Arrays, Classes, R-Programming Structures, Operations: Arithmetic, Logical and Matrix operations, Data frames, functions, Control structures, Debugging and Simulation in R.

UNIT-IV

Predictive Modeling : Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Logistic regression, Simulation in R.

UNIT-V

Classification: performance measures, Logistic regression implementation in R, K-Nearest neighbours (KNN), K-Nearest neighbours implementation in R, Clustering: K-Means Algorithm, K Means implementation in R. Time Series Analysis using R, Social Network Analysis, Reading data from relational databases- MySQL, Reading data from NoSQL databases- MongoDB.

TEXT BOOKS

1. Practical Data Science with R, Nina Zumel, II Edition, Manning Publications, 2014.

2. Practical Statistics for Data Scientists, Peter Bruce and Andrew Bruce, II Edition, O'Reilly, 2017.

3. R for Data Science, Hadley Wickham and Garrett Grolemund,II Edition, O'Reilly, 2017

REFERENCE BOOKS

1. R Programming for Data science, Roger D Peng, Lean Publishing, 2016.

2. Introduction to Data Science, Rafael A Irizarry, Lean Publishing,2016.

3. R Data Analysis cookbook, VishwaVishwanathan and ShanthiVishwanathan 2015.

Course Code	Course Title						Core/Elective
1ES501CS	DIGITAL IMAGE PROCESSING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to make the student to

1. To provide a approach towards image processing and introduction about 2D transforms
2. To expertise about enhancement methods in time and frequency domain
3. To expertise about segmentation and compression techniques
4. To understand the Morphological operations on an image

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Explore the fundamental relations between
2. pixels and utility of 2-D transforms in image
3. processer.
4. Implement the various Morphological operations on an image
5. Describe different techniques employed for the enhancement of images.
6. Understand different causes for image degradation and overview of image restoration techniques.
7. Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.

UNIT - I

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.

Image Transforms : 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT-II

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing,

Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering.

Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT - III
Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT - IV
Image Segmentation: Detection of Discontinuities, Edge Linking And Boundary Detection, thresholding, Region Oriented Segmentation.

Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation.

UNIT - V
Image Compression : Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

TEXT BOOKS
1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, III Edition, Pearson, 2008
2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- TMH, 2010, II Edition.

REFERENCE BOOKS
1. Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools - ScotteUmbaugh, II Edition, CRC Press, 2011
2. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, II Edition, TMH, 2010.
3. Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle- Cengage Learning (Indian edition) 2008.
4. Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, II Edition, BS Publication, 2008.

Course Code	Course Title						Core/Elective
1PE501AD	MOBILE COMPUTING						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
L	T	D	P				
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To make the student understand the concept of mobile computing paradigm, its novel applications and limitations.

2. To understand the typical mobile networking infrastructure through a popular GSM protocol

3. To understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer

4. To understand the database issues in mobile environments & data delivery models.

5. To understand the ad hoc networks and related concepts.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Develop new mobile application.

2. Understand new technical issue related to this new paradigm and come up with a solution(s).

3. Develop new adhoc network applications and/or algorithms/ protocols.

4. Understand & develop any existing or new protocol related to mobile environment.

UNIT - I

Introduction: Mobile Communications, Mobile Computing - Paradigm, Promises/ Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.

GSM - Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

UNIT - II

(Wireless) Medium Access Control (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11), 5G

Mobile Network Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.

UNIT - III

Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.

Database Issues : Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process &QoS Issues.

UNIT - IV

Data Dissemination and Synchronization : Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols

UNIT - V

Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc., Mobile Agents, Service Discovery.

TEXT BOOKS
1. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition.
2. Raj Kamal, "Mobile Computing", OXFORD UNIVERSITY PRESS.
3. Asoke K Talukder, et al, "Mobile Computing", Tata McGraw Hill, 2008.

REFERENCE BOOKS
1. Dr.Sunilkumar, et al "Wireless and Mobile Networks: Concepts and Protocols", Wiley India.
2. Matthew S.Gast, "802.11 Wireless Networks", SPD O'REILLY.
3. Ivan Stojmenovic , "Handbook of Wireless Networks and Mobile Computing", Wiley, 2007. Kumkum Garg, "Mobile Computing", Pearson.
4. Handbook of Security of Networks, Yang Xiao, Frank H Li, Hui Chen, World Scientific, 2011.

Course Code	Course Title						Core/Elective
1PE502AD	DATA MINING						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to make the student to

1. Introduce the basic concepts of Data Warehouse and Data Mining

2. Introduce current trends in data mining

3. Identify data mining problems and implement the data warehouse

4. Write association rules for a given data pattern.

5. Choose between classification and clustering solution.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the principles of Data Warehousing and Data Mining.

2. Implementing data warehouse architecture and its applications.

3. Organize and prepare the data needed for data mining using preprocessing techniques

4. Implement the appropriate data mining methods like classification, association and clustering on a given data set.

5. Understanding the importance of data mining application and using the most appropriate approach for the realistic strategy.

UNIT - I

Data Warehousing & Modeling :

Basic Concepts : Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.

Data warehouse implementation : Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.

UNIT - II
Introduction : What is data mining, Challenges, Data Mining Tasks, Major issues in data mining.

Data : Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity.

UNIT - III
Association Analysis : Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns. Correlation Analysis– Constraint based Association mining.

UNIT - IV
Classification and Prediction : Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines. Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor.

UNIT - V
Cluster Analysis : Types of Data in Cluster Analysis - A Categorization of Major Clustering Methods - Partitioning Methods - Hierarchical methods – Density-Based Methods - Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

TEXT BOOKS
1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson, First impression,2014.
2. Data Mining -Concepts and Techniques, Jiawei Han, MichelineKamber, Jian Pei, III Edition, Morgan Kaufmann Publisher, 2012.

REFERENCE BOOKS
1. Data Warehousing in the Real World, Pearson, Sam Anahory, Dennis Murray, X Impression, 2012.
2. Mastering Data Mining, Michael. J. Berry, Gordon. S. Linoff, Wiley Edition, II edtion, 2012.

Course Code	Course Title						Core/Elective
1PE503AD	SOFTWARE REQUIREMENTS AND ESTIMATION						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to make the student to :

1. To introduce good practices for requirements engineering.

2. To understand requirements elicitation and elicitation techniques.

3. To learn the usage of analysis models and software quality attributes.

4. To acquire knowledge on software estimation, size estimation, effort, schedule and cost estimation.

COURSE OUTCOMES:

After the completion of course the students will be able to :

1. Gain knowledge about software requirements, requirements management, their principles and practices.

2. Analyze requirement elicitation techniques and prototyping.

3. Analyze use-case modelling and different data diagrams.

4. Estimate software in terms of size, cost, effort and schedule.

UNIT - I

Software Requirements : What and Why : Essential Software requirement, Good practices for requirements engineering, Improving requirements processes, Software requirements and risk management.

Software Requirements Engineering : Requirements elicitation, requirements analysis documentation, review, elicitation techniques, analysis models, Software quality attributes, risk reduction through prototyping, setting requirements priorities, verifying requirements quality.

UNIT - II

Software Requirements Management : Requirements management Principles and practices, Requirements attributes, Change Management Process, Requirements Traceability Matrix, Links in requirements chain.

Software Requirements Modeling : Use Case Modeling, Analysis Models, Data flow diagram, state transition diagram, class diagrams, Object analysis, Problem Frames.

UNIT - III

Software Estimation : Components of Software Estimations, Estimationmethods, Problems associated with estimation, Key project factors that influence estimation.

Size Estimation : Two views of sizing, Function Point Analysis, Mark IIFPA, Full Function Points, LOC Estimation, Conversion between size measures.

UNIT - IV

Effort, Schedule and Cost Estimation: What is Productivity? Estimation F actors, Approaches to Effort and Schedule Estimation, COCOMOII, Putnam Estimation Model, Algorithmic models, Cost Estimation.

UNIT - V

Tools for Requirements Managementand Estimation

Requirements Management Tools : Benefits of using a requirements management tool, commercial requirements management tool, Rational Requisite pro, Caliber – RM, implementing requirements management automation.

Software Estimation Tools: Desirable features in software estimation tools, IFPUG, USC's COCOMOII, SLIM (Software Life Cycle Management) Tools.

TEXTBOOKS
1. Software Requirements and Estimation, Swapna Kishore, Rajesh Naik, I Edition, Tata Mc GrawHill, 2001
2. Software Requirements, KarlE.Weigers, II Edition, Microsoft Press, 2003

REFERENCE BOOKS
1. Managing Software Requirements, Dean Leffingwell & Don Widrig, Pearson Education, 2003.
2. Mastering the requirements process, II Edition, Suzanne Robertson & James Robertson, Pearson Education, 2006.
3. Estimating Software Costs, II Edition, Capers Jones, TMH, 2007.
4. Practical Software Estimation, M.A. Parthasarathy, Pearson Education, 2007.

Course Code	Course Title						Core/Elective
1PE504AD	PRINCIPLES OF PROGRAMMING LANGUAGES						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to make the student to

1. To understand the fundamental concepts of principles of language design, formal syntax and semantic, BNF.
2. To understand different data types, variables, expressions, types of statements, different types of control statements and iterations.
3. To understand the concept of Sub programs and blocks, operator overloading, and co- routines.
4. To understand the concept of Abstract data types, concurrency, exception handling of different programming languages and logic programming languages
5. To understand Functional Programming Languages like FPL, LISP, ML languages

COURSE OUTCOMES :

After the completion of course the students will be able to:

1. Ability to express syntax and semantics in formal notation.
2. Ability to apply suitable programming paradigm for the application.
3. Gain Knowledge and comparison of the features programming languages
4. Program in different language paradigms and evaluate their relative benefits.
5. Identify and describe semantic issues associated with variable binding, scoping rules, parameter passing, and exception handling.

UNIT - I

Preliminary Concepts: Reasons for studying, concepts of programming languages, Programming domains, Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms – Imperative, Object Oriented, functional Programming, Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments.

Syntax and Semantics: general Problem of describing Syntax and Semantics, formal methods of describing syntax- BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, attribute grammars, denotation semantics and axiomatic semantics for common programming languagefeatures.

UNIT - II

Data types : Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, type compatibility, named constants, variable initialization. Expressions and Statements: Arithmetic relational and Boolean expressions, Short circuit evaluation mixed mode assignment, Assignment Statements, Control Structures – Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, guarded commands

UNIT - III

Software Estimation : Components of Software Estimations, Estimationmethods, Problems.

Subprograms Blocks and Fundamentals of sub-programs : Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms , local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are subprogram names, design issues for functions user defined overloaded operators, co routines.

UNIT - IV

Abstract Data Types : Abstractions and Encapsulation, Introduction to Data Abstraction, Design Issues, Object Oriented Programming in C++, Java, Ada 95.

Exception Handling: Exceptions, Exception Propagation, Exception Handler in Ada, C++ and Java.

Logic Programming Language : Introduction and Overview of Logic Programming, Basic Elements of Prolog, Application of Logic Programming.

UNIT - V

Functional Programming Languages: Introduction, fundamentals of FPL, LISP,ML application of Functional Programming Languages and comparison of functional and imperative Languages. Key Concepts, Case Study: Python – Values and Types, Variables, Storage and Control, Bindings and Scope, Procedural Abstraction, Data Abstraction, Separate Compilation, Module Library.

TEXTBOOKS

1. Concepts of Programming Languages Robert .W. Sebesta,VIII Edition, Pearson Education, 2008.
2. Programming Languages Design Concepts, D. A. Watt, Wiley Dreamtech, rp - 2007.

REFERENCE BOOKS

1. Programming languages, A. B. Tucker, R E Noonan, II Edition, TMH
2. Programming Languages, K C Louden, II Edition, Thomson, 2003.
3. LISP Patric Henry Winston and Paul Horn Pearson Education.
4. Programming in PROLOG W F Clocksin& C S Mellish, V Edition, Springer.

Course Code	Course Title						Core/Elective
1PE505AD	ADVANCED DATABASES						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to make the student to :

1. To understand different data models that can be used for these databases.
2. To get familiarized with transaction management of the database
3. To develop in-depth knowledge about web and intelligent database.
4. To provide an introductory concept about the way in which data can be stored in geographical information systems etc

COURSE OUTCOMES :

After the completion of course the students will be able to:

1. Understand the concept of Distributed DBMS and concurrency control.
2. Acquire the knowledge on Object Oriented Databases.
3. Design web application by using markup language.
4. Understand advanced applications and active databases.
5. Understand mobile database and multimedia databases.

UNIT - I

Distributed DBMS Concepts and Design - Introduction -Functions and Architecture of DDBMS - Distributed Relational Database Design - Transparency in DDBMS - Distributed Transaction Management - Concurrency control - Deadlock Management - Database recovery -The X/Open Distributed Transaction Processing Model - Replication servers - Distributed Query Optimization - Distribution and Replication in Oracle.

UNIT - II

Object Oriented Databases - Introduction - Weakness of RDBMS - Object Oriented Concepts Storing Objects in Relational Databases - Next Generation Database Systems - Object Oriented Data models - OODBMS Perspectives - Persistence - Issues in OODBMS - Object Oriented Database Management System Manifesto -

Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group – Object Database Standard ODMG – Object Relational DBMS –Postgres - Comparison of ORDBMS and OODBMS.

UNIT - III

Web Technology And DBMS - Introduction - The Web - The Web as a Database Application Platform - Scripting languages - Common Gateway Interface - HTTP Cookies - Extending the Web Server - Java -Microsoft's Web Solution Platform - Oracle Internet Platform - Semi structured Data and XML - XML Related Technologies - XML Query Languages.

UNIT - IV

Enhanced Data Models For Advanced Applications - Active Database Concepts And Triggers -Temporal Database Concepts – Deductive databases – Knowledge Databases

UNIT - V

Mobile Database – Geographic Information Systems – Genome Data Management – Multimedia Database – Parallel Database – Spatial Databases - Database administration – Data Warehousing and Data Mining

TEXT BOOKS

1. Database Systems - A Practical Approach to Design , Implementation , and Management", Thomas M. Connolly, Carolyn E. Begg, III Edition , Pearson Education, 2003

2. Patrick Valduriez M. TamerOzsu, Principles of Distributed Database Systems, II Edition, Prentice Hall, 1999.

REFERENCE BOOKS

1. "Fundamentals of Database Systems", Ramez Elmasri & Shamkant B.Navathe, IV Edition , Pearson Education , 2004.

2. "Principles of Distributed Database Systems", M.TamerOzsu, Patrick Ualduriel, II Edition, Pearson Education, 2003.

Course Code	Course Title						Core/Elective
1OE501AD	ARTIFICIAL INTELLIGENCE						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to make the student to

1. To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state.

2. To introduces different knowledge representation methods in AI Programs.

3. To introduce different design techniques for Game Playing Programs.

4. To introduce the AI Agents their design, planning and learning techniques.

5. To introduce the natural language processing and expert systems.

COURSE OUTCOMES :

After the completion of course the students will be able to:

1. Understand fundamental AI concepts and identify a range of symbolic and non-symbolic AI techniques.

2. Demonstrate an understanding of various searching algorithms such as adversarial search and game-playing commonly used in artificial intelligence software.

3. Use different knowledge representation techniques used in AI Applications.

4. Demonstrate an understanding of agent based AI architectures, Planning and logic based agents.

5. 5.Exploring Expert systems.

UNIT - I

Introduction : Artificial Intelligence and its applications, Artificial Intelligence Techniques.

Problem solving techniques : State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, AO* search, Constraint satisfaction problem, Agenda Driven Search, Mean-end analysis, Min- Max Search, Alpha-Beta Pruning, Iterative Deepening.

UNIT - II

Knowledge representation: Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Weak and Strong filler structures.

UNIT - III

Non Monotonic and Statistical Reasoning : on monotonic Logic, Default Logic, Circumscription, Bayes Theorem, Bayesian Network, Dempster Shafer Theory, Fuzzy sets, Fuzzy Logic, Defuzzification.

UNIT - IV

Planning and Learning Agents : Intelligent Agents, Nature and structure of Agents, Learning Agents, Introduction to different Forms of Learning, The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

UNIT - V

Introduction to Learning and Expert system: Expert systems, Expert system examples, Expert System Architectures, Rule base Expert systems, Non Monotonic Expert Systems, Decision tree base Expert Systems.

TEXT BOOKS

1. AI: A Modern Approach Stuart J. Russel, Peter Norvig Pearson Education Latest Edition, 2012
2. Artificial Intelligence Elaine Rich, Knight McGraw Hill Third Edition2010
3. Artificial Intelligence, Saroj Kaushik Cengage Learning, First Edition2011

REFERENCES

1. Artificial Intelligence, Partick Henry Winston Addison Wesley Latest Edition 2012.
2. Artificial Intelligence George Luger Pearson Education Latest Edition 2010.

Course Code	Course Title						Core/Elective
1PC559AD	DATA SCIENCE LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES :

The objective of this course is to make the student to :

1. Understand the R Programming Language.

2. Understand and apply the data analytics technique for visualization

3. Understand pull data from different sources (small dataset and large datasets), clean and manipulate data

4. Understand the classification and regression model.

5. Exposure on solving of data science real world problems.

COURSE OUTCOMES :

After the completion of course the students will be able to:

1. Understand the concept of Setup R Programming Environment.

2. Develop programming logic using R-data types, R-Data Structures and R – Packages.

3. Analyze data sets using R – programming capabilities.

4. Apply various classification and regression models.

5. Apply various clustering techniques on different data sets

List of Programs :

1. R AS CALCULATOR APPLICATION
   a. Using with and without R objects on console
   b. Using mathematical functions on console
   c. Write an R script, to create R objects for calculator application and save in a specified location in disk.

2. DESCRIPTIVE STATISTICS IN R
   a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.
   b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset

3. READING AND WRITING DIFFERENT TYPES OF DATASETS
   a. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.
   b. Reading Excel data sheet in R.
   c. Reading XML dataset in R
4. VISUALIZATIONS
   a. Find the data distributions using box and scatter plot.
   b. Find the outliers using plot.
   c. Plot the histogram, bar chart and pie chart on sample data
5. CORRELATION AND COVARIANCE
   a. Find the correlation matrix.
   b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
   c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data
6. REGRESSION MODEL
   Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS)
7. MULTIPLE REGRESSION MODEL
   Apply multiple regressions, if data have a continuous Independent variable. Apply on above dataset
8. REGRESSION MODEL FOR PREDICTION
   Apply regression Model techniques to predict the data on above dataset.
9. CLASSIFICATION MODEL
   a. Install relevant package for classification.
   b. Choose classifier for classification problem.
c. Evaluate the performance of classifier.
10. CLUSTERING MODEL
    a. Clustering algorithms for unsupervised classification.
    b. Plot the cluster data using R visualizations.
11. Write R program to find all elements of a given list that are not in another given list.
12. Write a R program to show plot using the mosaicplot() function.
13. Write a R program to show plot using stripchart() and QQ Plots.

Course Code	Course Title						Core/Elective
1ES551CS	DIGITAL IMAGE PROCESSING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES :

The objective of this course is to make the student to

1. To introduce the concepts of image processing and basic analytical methods to be used in image processing.
2. To familiarize students with image enhancement and restoration techniques.
3. To explain different image compression techniques.
4. To introduce segmentation and morphological processing techniques.

COURSE OUTCOMES :

After the completion of course the students will be able to:

1. Understand how the images are read as grayscale and RGB.
2. Understand how the images are getting converted in different forms.
3. Understand the processing and implement different image filtering techniques
4. Implement Edge detection.
5. Compare the different DFT, DCT and DWT techniques.

List of Programs :

1. OpenCV installation.
2. Reading, Writing and Storing Images.
3. Reading an Image as Grayscale.
4. Reading Image as RGB.
5. Image Conversion - Colored Images to GrayScale.
6. Image Conversion - Colored Image to Binary.
7. Processing – Blur – Averaging, Gaussian.
8. Image Filtering - Bilateral Filter, Box Filter, Erosion.
9. Thresholding – Simple, Adaptive.
10. Sobel Operator.
11. DFT, DCT, DWT.
12. Edge Detection.

Course Code	Course Title						Core/Elective
1PW560AD	SKILL DEVELOPMENT COURSE III						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES :

The objective of this course is to make the student to :

1. Able to identify the basic components of an Android app, such as activities, layouts, and views.
2. Be able to use layouts to arrange your user interface elements in a logical and efficient way.
3. Be able to store data in the app's internal storage, or in a cloud-based storage service.
4. Able to add that feature to an existing Android app.
5. Able to deploy that app to the Google Play Store.

COURSE OUTCOMES :

After the completion of course the students will be able to :

1. Understand the basics of Android development, including the Android Studio IDE, the Android SDK, and the AndroidManifest.xml file.
2. Create an app with multiple activities that can communicate with each other using intents.
3. Create a variety of user interface elements, such as buttons, text fields, and checkboxes.
4. Use layouts to arrange their user interface elements in a logical and efficient way.
5. Understand how to store data in Android apps, using both local and remote storage options.

List of Programs :

1. Portable Devices Overview.

    1.1. Introduction to SW development for portable devices.

    1.2. Overview of Portable Devices.

    1.3. HW & SW for Portable Devices.

8.5. Using Audio Effects

8.6. Using the Camera

8.7. Recording Video

8.8. Adding Media to the Media Store

TEXT BOOKS

1. Professional Android 4 Application Development, by Reto Meier, WROX Press, Wiley Publishing.

REFERENCE BOOKS

1. Android Application Development, Programming with the Google SDK, by, Rick Rogers, John Lombardo, ZigurdMednieks, Blake Meike, SPD, Oreilly, ISBN10: 81-8404-733-9, ISBN13:978-81-8404-733-2

2. Hello Android, Introducing Google's Mobile Development Platform, 3rd Edition, by Ed Burnette, Pragmatic Programmers, LLC.ISBN-10: 1-934356-56-5, ISBN-13: 978-1-934356-56-2.

Course Code	Course Title						Core/Elective
OE501CE	Disaster Mitigation						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES :

Upon completion of this course, students will bea ble to:

1. Define disaster and explain the different types of disasters.

2. Describe the disaster management cycle and therole of NDMA in disaster management.

3. Analyze the legal aspects of disaster management.

4. Develop disaster mitigation plans.

5. Participate in disaster response and recoveryactivities.

COURSE OUTCOMES :

After the completion of course the students will be able to:

After completion of the course, the student will be able to

CO1. Demonstrate the concepts of disastermanagement.

CO2. Identify different types of disasters.

CO3. Explain the disastermanagement cycle.

CO4. Illustrate the role of NDMA in disastermanagement.

CO5. Explain the development of disastermitigation plan.

UNIT - I

Introduction to Disaster Management : Definition of disaster, Types of disasters, History ofdisaster management in India, National Disaster Management Authority (NDMA) and its role indisastermanagement, Disaster management cycle. Case studies of disasters in India and the world

UNIT - II

Disaster Mitigation : Mitigation measures for different types of disasters, Use of technology indisaster mitigation, Disaster risk assessment, Disaster preparedness, Exercises and simulations ondisastermitigation.

UNIT - III

Disaster Response : Search and rescue operations, Medical relief, Food and shelter, Restoration of essential services, Rehabilitation and reconstruction,

UNIT - IV

Disaster Law and Policy : Disaster management acts of India, Disaster management policies of India, Legalaspects of disastermanagement.

UNIT - V

Disaster Communication and Public Awareness : Importance of communication in disaster management, Methods of disaster communication, Public awareness programs, Case studies of disaster communication and public awarenessin India and the world.

TEXT BOOKS

T1.R.Subramanian, Disaster Management, Vikas Publishing House, 2018.
T2.M.M.Sulphey, Disaster Management, PHI Learning, 2016.

REFERENCE BOOKS

R1. S. C. Sharma, Disaster Management : Concepts, Approaches and Techniques, Khanna Book Publishing House, 2017.

R2.G.K.Ghosh, Disaster Management: Theory and Practice, APH Publishing Corporation, 2018.

Course Code	Course Title						Core/Elective
3OE501CS	OOPS USING JAVA						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. The Java programming language : its syntax,idioms,patternsandstyles.

2. Object oriented concepts in Java and apply for solving the problems.

3. How exception handling and multithreading makes Java robust.

4. Explore java Standard AP I library such asio, util, applet, awt.

5. Building of applications using Applets and Swings.

COURSE OUTCOMES :

1. Understand the concept of OOP and analyze relationships among classes, objects.

2. Develop programsusing concepts like inheritance, packages, interfaces, JavaI/ Ostreams and strings.

3. Utilize exception handling and Multithreading concepts to develop Java programs.

4. Interpret the Java Collection API, Javautility classes, concept of files and serialization

5. Design GUI applications using concept slike AWT controls and Swings and client server programs using networking concepts.

UNIT - I

Object Oriented Programming : Principles, Benefits of Object Oriented Programming. Introduction to Java : Java buzz words, bytecode. Java Programming Fundamentals: Applet and Application programusing simple java program, data types, variables, arrays, operators, expressions, control statements, type conversion and casting, concepts of classes, objects, constructors, methods, accesscontrol, this keyword, garbage collection, overloading methods and constructors, introducing access control, static, final, nested and inner classes, exploring stringclass, using command - linear arguments.

Inheritance: Inheritance concept, types of inheritance, Member access rules, use of super and final.

Polymorphism - dynamic binding, method over riding, abstract classes and methods.

UNIT - II
Interfaces : Defining an interface, implementing interfaces, extending interface.

Packages : Defining, Creating and Accessinga Package, importing packages

Exception handling : Benefits of exception handling, classification, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re throwing exceptions, built in exceptions, creating own exception sub classes.

Multithreading: Java Thread Model, The Main Thread, creating a Thread, creating multiplethreads, usingis Aliveand join, threadpriorities, synchronization, interthread communication, deadlock.

UNIT - III
Collections : Overview of Java Collection frame work, commonly used Collection classes - Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection viaiterator, working with Map. Legacy classes an dinterfaces - Vector, Hashtable, Stack, Dictionary, Enumeration interface.

Other Utility classes : String Tokenizer, Date, Calendar, Gregorian Calendar, Scanner JavaInput/Output : exploring java.io, JavaI/Oclassesandinterfaces, File, Stream classes, bytestream, characterstream, serialization..

UNIT - IV
GUI Programming with java : The AWT class hierarchy, MVC architecture.

Applet Revisited : Basics,architecture and skeleton, simple applet program.

Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Inter faces. Handling mouse and keyboard events, Adapter classes.

Database Programming using JDBC: Introduction to JDBC, JDBC Drivers &Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.

UNIT - V
Exploring Swing : JLabel, Image Icon, JText Field, the Swing buttons, JTab bed pane, JScroll Pane, JList, J Combo Box.

Servlet : Lifecycle, using tomcat, simpleservlet, servlet API, javax.servlet package, reading servlet parameters, javax.servlet.httppackage, handling HTTP requests and responses.

TEXT BOOKS

1. Java : The Complete Reference, X Edition, Herbert Schildt, Mcgraw Hill.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildtand Dale Skrien, TMH.
3. Java for Programming, P.J.Dietel X Edition, Pearson Education.

REFERENCE BOOKS

1. The Java Programming Language, Ken Arnold, David Holmes, James Gosling, Prakash Goteti, III Edition, Pearson 2008.
2. An Introduction to OOP, T.Budd, III Edition, Pearson Education.
3. Introduction to Java Programming.
4. Daniel Liang, X Edition, Pearson Education.

Course Code	Course Title						Core/Elective
5OE501EC	Basics of Electronic Communication						Elective
Prerequisite	Contact Hoursper Week				CIE	SEE	Credits
	L	T	D	P			
BEE	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To provide an introduction to fundamental concepts in the understanding of communications systems.

2. To describe the network model and some of the network layers including physical layer, data link layer, network layer and transport layer.

3. To discuss the evolution of wirelesssy stems and current wireless technologies.

COURSE OUTCOMES :

At the end of the course, the students will be able to :

1. Understand the working of an alog and digital communication systems.

2. Explain the OSI network model and theworking of data transmission.

3. Describe the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.

4. Differentiate between an alog and digital modulation techniques.

5. Understand the optical fiber communication link, structure, propagation and transmission properties.

UNIT - I

Introductionto Communication systems : Electro magnetic Frequency Spectrum, Signalanditsrepresentation, Elements of Electronic Communications System,Typesof Communication Channels.

Signal Transmission Concepts: Baseband transmission and Broadband transmission, Communication Parameters : Transmitted power, Channel bandwidth and Noise, Need for modulation Signal Radiationand Propagation : Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT - II

Analog and Digital Communications : Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes– ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT - III

Data Communication and Networking : Network Models, OSI Model, Data Link Layer– MediaAccess control, Ethernet, Network Layer – Internet Protocol (IPv4/ IPv6), Transport Layer – TCP, UDP.

UNIT - IV

Telecommunication Systems : Telephones, Telephone system, Optical Communications : Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers,Wavelength Division Multiplexing.

UNIT - V

Wireless Communications : Evolution of Wireless Systems : AMPS, GSM, CDMA, WCDMA, OFDM. Current Wireless Technologies : Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireles smesh networks, Vehicular adhoc networks.

TEXT BOOKS:

1. LouisE. Frenzel, "Principles of Electronic Communication Systems", 3rd edition, McGraw Hill, 2008.

2. George Kennedy, Bernard Davis, "Electronic Communication systems", 4th edition, Mc Graw Hill,1999.

REFERENCE BOOKS:

1. Behrouz A.Forouzan, "Data Communications and Networking", 5th edition, TMH, 2012.

2. RappaportT.S.,"Wireless communications", 2nd edition, Pearson Education, 2010.

3. Wayne Tomasi, "Advanced Electronic Communications Systems", 6th edition, Pearson Education.

Course Code	Course Title	Core/Elective					
4OE501EE	RENEWABLE ENERGY SYSTEMS (OPENELECTIVE–I)	Elective					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

COURSE OBJECTIVES :

The objectives of this course is to impart knowledge of :

1. To understand the concepts and Importance of renewable energy sources such as solar, wind, biomass, tidal power.

2. To make the students understand the advantages and disadvantages of different renewable energy sources.

COURSE OUTCOMES :

At the end of the course students will be able to :

1. Explain the advantages, disadvantages and applications of different conventional and non-conventional sources.

2. Acquire the knowledge of various components, principle of operation and present scenario of different conventional and non-conventional sources.

UNIT - I

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non-conventional energy sources - Fuel Cells - Principle of operation with special reference to $H_2 \,°_2$ Cell - Classification and Block diagram of fuelcell systems-Ionexchange membrane cell-Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system - Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells - Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT - II

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond - Application of Solar Pond-Applications of solar energy, V-I and P-V curves and the concept of MPPT.

UNIT-III

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS - Classification of WECS - Site

selection considerations - Advantages and disadvantages of WECS - Wind energy collectors -Wind electric generating and control systems-Applications of Wind energy - Environmental aspects.

UNIT - IV

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation - Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

UNIT - V

Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation-Thermal gasification of biomass-Biomass gasifiers.

TEXT BOOKS :

1. Rai G.D, Non-Conventional Sources of Energy, Khandala Publishers, NewDelhi, 2011.

2. David M Buchla and Thomas E Kissell, Renewable Energy Systems, 1st Edition by, Pearson India.

REFERENCES/ SUGGESTEDREADING:

1. M.M.El-Wakil, Power Plant Technology, Mc Graw Hill, 1984.

2. John Twidell, Tony Weir, Renewable Energy R73 esources, 3rd Edition, Taylor and Francis.

Course Code	Course Title						Core/Elective
6OE501ME	START-UP ENTREPRENEURSHIP						Elective
Prerequisite	Contact Hoursper Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES :

Students should be able to understand :

1. To motivate students to takeup entrepreneurship infuture.

2. To learn nuances of starting an enterprise & project management.

3. To understand project formulation and choiceTechnology in Enterprise.

4. To underst and Intellectual properties, patents, Start-ups.

COURSE OUTCOMES :

After the completion of course the students will be able to:

1. Understand Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms of enterprises.

2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideasand their sources.

3. Practice the principles of project formulation, Analysis of marketdem and, Financial and profitability analysis and Technical analysis.

4. Understand the concept of Intellectual Property Rights and Patents

5. Comprehend the aspects of Start-Ups.

UNIT - I

Entrepreneurship : Definition, functions of Entrepreneurship, Characteristics and qualities of entrepreneurs, Entrepreneur vs. entrepreneur, need of innovation, Economic growth. Small Scale Industry in India, Linkage among small, medium and heavy industries.

UNIT - II

Indian Industrial Environment : Competence, Opportunities and Challenges, Emergence of First generation entrepreneurs, women entrepreneurs. Conception and evaluation of ideas and their sources. Types of enterprises. Collaborative interaction for Technology development. Corporate Social Responsibility.

UNIT - III

Project formulation : Introduction, Elements of Business Plan and its salient features, Analysis of market demand, Financial and profitability analysis and Technical analysis.

UNIT - IV

Intellectual Property Rights : Meaning, Nature, Classification and protection of Intellectual Property, the main forms of Intellectual Property, Concept of Patent, Patent document, Invention protection, Granting of patent, Rights of apatent, Licensing, Transfer of technology.

UNIT - V

Aspects of Start-Up : What is Start-Up, Start-up Policy, start-up strategy, Progress of startupsin India, Principles of future organizations, start-up sectors and action plan for start-ups by Govt. of India.

TEXT BOOKS :

1. VasantDesai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House,

2. Prasanna Chandra, "Project- Planning, Analysis, Selection, Implementation and Review", Tata McGraw-Hill Publishing Company Ltd.

3. Ajit Parulekar and SaritaD'Souza, Indian Patents Law–Legal & Business Implications, Macmillan India Ltd.

REFERENCE BOOKS :

1. Stephen R.Covey and A.Roger Merrill,"First Things First", Simon and Schuster Publication.

2. G.S.Sudha, "Organizational Behaviour".

3. Robert D.Hisrich, MichaelP.Peters, "Entrepreneurship", Tata MeGraw Hill Publishing Company Ltd., 5lh Ed.

4. G.B.Reddy, Intellectual Property Rights and the Law 5th Ed.Gogia Law Agency.