SARVAJANIK UNIVERSITY
INCLUSIVE | INTEGRATED | INNOVATIVE

Faculty of Science

Shree Ramkrishna Institute of Computer Education & Applied Sciences, Surat

M.Sc. Web and Mobile Technology

SEMESTER- 1

DCS-1: Fundamentals of Data Science

Course Code	
Course Title	**Fundamentals of Data Science**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	-
Purpose of Course	The purpose of the course is to make students capable of implementing Concepts , methods related to data science
Course Objective	◆ To learn about fundamentals of data science ◆ To study various case studies of and implementation about data science .
Prerequisite	Basic concept of Python Programming and Data Mining
Course Out come	After completion of this course, the student will be capable to develop models and implement predictive analytics on social media platforms
Course Content	**Unit 1 Introduction to Data Science and Data-Analytics** 1.1 Problems, Data Opportunities and Solutions 1.2 Data Science, Engineering, and Data-Driven Decision Making 1.3 Data Processing and "Big Data" 1.4 Data-Analytic Thinking 1.5 Data Mining and Data Science 1.6 Overview of the data science process 1.7 Business Perspective of Data Science Project **Unit 2 Data in Data Science** 2.1 Defining Data Science 2.2 Facets of Data 2.2.1. Structured data 2.2.2. Unstructured data 2.2.3. Natural language 2.2.4. Machine-generated data 2.2.5. Graph-based or network data 2.2.6. Audio, image, and video 2.3 Understanding Data 2.3.1 Types of Data Sources 2.3.2 Data Sampling 2.3.3 Types of Data Elements 2.3.4 Data quality checks **Unit 3 Data Extraction** 3.1 Working with real data 3.3.1Reading from text file 3.3.2 Reading from CSV file

	3.3.3 Reading from Excel and Other Files 3.3.4 Third Party Data Integration **Unit 4 Data Pre-processing** 4.1 Cleansing, integrating, and transforming data, Cleansing data 4.2 Missing values, outlier detection and treatment 4.3 Combining data from different data sources 4.4. Transforming data **Unit 5 Data Modelling** 5.1 Overview of Descriptive and Predictive Analytics Models 5.1.1 Linear and Logistic Regression 5.1.2 Decision Trees 5.1.3 Support Vector Machine 5.1.4 Association Rule Mining 5.2. Build the models 5.2.1. Model and variable selection 5.2.3. Model execution 5.3 Model Evaluation 5.4 Converting model into applications **Unit 6 Exploratory Data Analysis** 6.1 Defining Descriptive Statistics for Numeric Data 6.2 Analyzing Categorical Data 6.3 Co-relation Analysis 6.4 Modifying Data Distribution **Unit 7 Data Visualization and Analytics** 7.1 Application of Visual Analytics 7.2 Understanding graphs 7.2.1 Heat Maps 7.2.2 Time Series Plots 7.2.3 Box Plots 7.2.4 Network Graphs 7.2.5 Spatial Data Mapping **Unit 8 Application and Case Studies** 8.1 Applications for machine learning in data science 8.2 Introduction to Predictive Analytics and case study 8.3 Introduction to Descriptive Analytics and case study 8.4 Social Network Analytics and case study 8.5 Introduction to Web Analytics and case study
Reference Bookss	1. Introducing Data Science - Big data, machine learning, and more, using Python tools 2. Analytics in a Big Data World - Bart Baesens, Wiley Publications 3. Python Data Science FOR Dummies - John Paul Mueller, Luca Massaron - Wiley Publication 4. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, Mannin Publication

	5. Data Science for Business, Tom Fawcett, Foster Provost , O'relly Publication 6. Python Data Science Handbook, Jake VanderPlas, O'relly Publication 7. https://www.iitmandi.ac.in/academics/files/B.TechinDataScience.pdf
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	70% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 30% assessment is based on semester end written examination

DCS-2 Web Programming -1

Course Code	
Course Title	**Web Programming -1**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	
Purpose of Course	The purpose of the course is to make students capable of developing professional web applications using latest tools and technologies.
Course Objective	To provide an in-depth knowledge of most recent server side programming technology.
Prerequisite	Basic understanding of Web, HTTP, HTML, JavaScript, Basic Web Programming .
Course Outcome	After completion of this course, the student will be capable of developing.
Course Content	**Unit 1 Web technologies - Basic Concepts** 1.1 Client – Server Architecture 1.2 Manage Cross-page posting 1.3 Web Page State Management Concepts 1.3.1 Session 1.3.2 Query String 1.3.3 Cookie **Unit 2 MVC Architecture** 2.1 Introduction to MVC Framework 2.2 Building an MVC page 2.3 Web Page Routing 2.4 Controller, Model, and View 2.5 Data Access and Modeling 2.6 CRUD operation in MVC 2.7 Entity framework – ORM model **Unit 3 Database Concepts** 3.1 Working with external Database 3.2 Introduction to LINQ 3.3 Lambda Expression 3.4 Query Expression 3.5 Data Access with LINQ 3.5.1 Introduction of LINQ 3.5.2 LINQ to Dataset 3.5.3 LINQ to SQL **Unit 4 Web Application Security** 4.1 Authentication 4.1.1 Forms Authentication

	4.1.2 Windows Authentication 4.2 Authorization 4.3 Role-Based Security 4.4 SQL injection **Unit 5: Working with E-mail** 5.1 Introduction 5.2 SmtpClient Class 5.2.1 SmtpClient Class properties 5.3 MailMessage Class 5.4 Attachment Class **Unit 6: Web Services** 6.1 Basic of Web Services 6.2 Discovering Web Services Using UDDI 6.3 Creating a Web Service 6.4 Web Service Consumers 6.5 Web Service using RESTful, Web Service SOAP **Unit 7: Working with Web API** 7.1 Introduction to Web API 7.2 Web API Controller 7.3 Web API Routing 7.4 Implementing Http Get Request 7.5 Implementing Http Put Request 7.6 Implementing Http Post Request 7.7 Implementing Http Delete Request **Unit 8: CICD using Github** 8.1 Overview of Continuous integration 8.2 Github Actions 8.3 Github Action Components 8.3.1 Workflow files 8.3.2 CI with workflow templates 8.3.3 Viewing job activity
References	1. Professional ASP.NET MVC 5 by Jon Galloway, Wrox, 2014 2. Pro ASP.NET MVC 5 Platform by Adam Freeman, Apress 3. Professional C# 7 and .NET Core 2.0 by Christian Nagel, Wrox / Wiley, 2018 4. C# 7 and .NET Core Cookbook by Dirk Strauss, O'Reilly / Packt Publishing Limited, 2017 5. Learning ASP.NET Core 2.0 by Jason De Oliveira and Michel Bruchet, Packt Publishing Ltd, 2017 6. Mastering ASP.NET Core 2.0 by Ricardo Peres, Packt Publishing Limited, 2017 7. Black Book “Java server programming” J2EE, 1st ed., Dream Tech

	Publishers, 2008. 3. Kathy walrath" 8. Complete Reference J2EE by James Keogh mcgraw publication 9. Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest Wiley Publication 10. Core Java, Volume II: Advanced Features by Cay Horstmann and Gary Cornell Pearson Publication 11. Java Persistence with Hibernate by Christian Bauer, Gavin King 12. Spring in Action 3rd edition , Craig walls, Manning Publication 13. Hibernate 2nd edition, Jeff Linwood and Dave Minter, Beginning Après publication 14. Java Server Faces in Action, Kito D. Mann, Manning Publication 15. JDBC™ API Tutorial and Reference, Third Edition, Maydene Fisher, Jon Ellis, Jonathan Bruce, Addison Wesley 16. Beginning JSP, JSF andTomcat, Giulio Zambon, Apress
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	70% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 30% assessment is based on semester end written examination

SEC 1 Advanced Database Technologies

Course Code	
Course Title	**Advanced Database Technologies**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	
Purpose of Course	The purpose of course is to make students use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
Course Objective	To provide Fundamental knowledge of the detailed architecture, define objects, load data, query data and performance tune NoSQL databases.
Prerequisite	Basic understanding of Database Concepts.
Course Outcome	After completing this course, a learner will be able to identify what type of NoSQL database to implement based on business requirements, can able to apply NoSQL data modeling from application specific queries
Course Content	**Unit 1: Database Basics** 1.1 Type of Database Systems 1.1.1 Relational Database Design 1.1.2 E-commerce Application 1.1.3 Early Database Management Systems 1.1.4 Flat File Data Management Systems 1.1.5 Organization of Flat File Data Management Systems 1.1.6 Hierarchical Data Model Systems **Unit 2: Variety of NoSQL Databases** 2.1 Data Management with Distributed Databases 2.2 Store Data Persistently, Maintain Data Consistency, Ensure Data Availability 2.3 Balancing Response Times, Consistency, and Durability Consistency, Availability, and Partitioning: The CAP Theorem 2.4 ACID and BASE 2.4.1 ACID: Atomicity, Consistency, Isolation, and Durability 2.4.2 BASE: Basically Available, Soft State, Eventually Consistent **Unit 3: Types of NoSQL Databases** 3.1 Key-Value Pair Database 3.2 Document Database 3.3 Column Family Databases 3.4 Graph Databases 3.5 Time-series Database **Unit 4: MongoDB** 4.1 The Document Data Model

	4.2 Documents and Collections 4.3 Mongo Shell **Unit 5: MongoDB Databases** 5.1 Working Database – create, drop 5.2 Working with collections – create, drop 5.3 Working with Document – Adding batch of document, find document, modify document, find selected fields, removing document 5.4 Indexing 5.5 Writing to Shards 5.6 MongoDB as a File System **Unit 6: Cassandra** 6.1 The Column-Family Data Model 6.2 Databases and Tables 6.3 Columns, Types, and Keys 6.4 Cassandra's Architecture **Unit 7: Cassandra with Databases** 7.1 Cypher Query Language (CQL) 7.2 CQL Types 7.3 Writing and reading Data 7.3.1 Writing – write path, writing files to disk, transactions 7.3.2 Reading – read path, range queries, ordering, filtering, paging, deleting **Unit 8: Neo4j** 8.1 The Graph Databases – navigational db, relational db, NoSQL db 8.2 Neo4j building blocks 8.3 Key value stores 8.4 Cypher Query Language – Nodes, relationships 8.5 Write clause – Set, Delete, 8.6 Read clause – Match clause, Where clause 8.7 The Neo4j REST API
Reference Books	1. Designing Data-Intensive Applications By Martin Kleppmann-O'Reilly 2. NoSQL for Mere Mortals® By Dan Sullivan-O'Reilly 3. Pro MongoDB™ Development By Deepak Vohra 4. MongoDB in Action By Kyle Banker 5. Cassandra: The Definitive Guide By Eben Hewitt 6. Nosql Web Development With Apache Cassandra by Deepak Vohra 7. Learning Neo4j By Rik Van Bruggen
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment

Evaluation Method	70% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 30% assessment is based on semester end written examination

104-Elective: Cyber Security and Forensics-1

Course Code	
Course Title	Cyber Security and Forensics-1
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	-
Purpose of Course	Conceptualize the students with the theoretical concepts of Cyber Security
Course Objective	Familiarization with different objectives of cyber security components like identity theft, different hacking techniques used for different purposes. Different mobile and cloud security components are also covered.
Prerequisite	Basic knowledge of Information security, computer network and operating systems.
Course Out come	1. Get familiar with different terminologies of cyber security 2. Get aware with different techniques of identity theft 3. Gaining detail knowledge to support activities associated with mobile and cloud security.
Course Content	Basic terminology associated with cyber security, basics of cyber security, techniques associated with identity theft, Different techniques used by attacker to capture important and confidential information. Moreover techniques associated with mobile security and cloud based security components are covered along with selected case studies.
	Unit 1: Introduction 1.1 Introduction & defining the cyber security challenges 1.2 Ethical hacking 1.3 Frauds in IT, Banking, Mobile network, telecommunications 1.4 Frauds in Software development and management 1.5 Types of Areas in Cyber Security **Unit 2: Basics of cyber security** 2.1 Pathway of Cyber Security 2.2 lassification of cyber crime 2.3 Provision of IT Act -2000 and it's amendment 2.4 Careers in cyber security **Unit 3: Identity theft** 3.1 Phishing 3.1.1 Phishing 3.1.2 Methods and techniques of phishing 3.1.3 Types of phishing scam 3.1.4 Phishing counter measures

	3.1.5 Mishing, smishing and vishing 3.2 Identity theft 3.2.1 Assumption of Identity 3.2.2 Credit Identity theft 3.2.3 Virtual Identity theft 3.2.4 Criminal Record Identity theft/fraud 3.3 Physical Method of Identity theft 3.3.1 Mail theft 3.3.2 Dumpster diving 3.3.3 Theft of computer 3.3.4 Bag operations 3.3.5 Child Identity theft 3.3.6 Insiders 3.3.7 Fraudulent or fictitious companies 3.3.8 Card skimming , ATM manipulation and fraudulent machines 3.4 Theft of Intellectual Property 3.4.1 Software piracy 3.4.2 Film and music piracy **Unit 4: Different attacks** 4.1 Password cracking 4.1.1 Online and offline attack 4.1.2 Brute force attack 4.1.3 Strong, weak and random password 4.1.4 Dictionary attack 4.2 Key logger and spywares 4.2.1 Hardware and software loggers 4.2.2 Anti key logger 4.2.3 Spywares **Unit 5: Different attack techniques** 5.1 DOS and DDOS attacks 5.1.1 Classification of DOS attacks 5.1.2 Types / levels of DOS attacks 5.1.3 Tools used to launch DOS attacks 5.1.4 DDOS attacks 5.1.5 Protect from DOS Attacks 5.2 SQL Injection 5.2.1 Steps for SQL Injection 5.2.2 How to prevent from SQL Injection attacks 5.2.3 Tools used for SQL server penetration. 5.2.4 Buffer overflow - types and minimize the attack.

	5.3 Botnets and Zombie armies 5.4 Cyber terrorism and organized crime **Unit 6: Introduction to Computer forensics** 6.1 Computer forensic 6.2 Computer forensic applications 6.3 Forensic services 6.4 Types of forensic technology 6.5 Benefits of professional forensic methodology **Unit 7: Electronic evidence collection** 7.1 Alternative methods for accessing data 7.2 Collecting digital evidence data 7.3 Digital evidence processing and investigation 7.4 Evidence preservation **Unit 8: Electronic evidence processing** 8.1 Evidence data analysis 8.2 Evidence data documentation 8.3 Database forensic 8.4 Web attack forensic 8.5 Evidence presentation
Reference Bookss	1. Cyber security, Nina Godbole, Sunit Belapure, Wiley 2. Computer Forensics – Computer Crime scene investigation by John R Vacca, Firewall media publication 3. Computer forensics and cyber crime – an introduction 3rd edition, Marjie T. Britz, Pearson 4. Build your own security lab, Michael Gregg, Wiley India 5. Introduction to computer security by Matt Bishop 6. Cryptography and network security by William Stalling
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	70% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 30% assessment is based on semester end written examination.

Elective - Web Engineering

Course Code	
Course Title	**Web Engineering**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	
Purpose of Course	The purpose of the course is to make students capable of understanding and implementing Web engineering concepts, approaches and methodologies.
Course Objective	To provide a comprehensive knowledge of and Practical Environment for Web Engineering methodologies and approaches
Prerequisite	Basic Concept of Software Engineering.
Course Out come	After completion of this course, the student will be capable of : a) Identifying Specific requirements pertaining to Web Applications in context b) Designing Web Applications following sound principle and methods c) Testing Web Applications and managing the changes in it.
Course Content	**Unit 1 Web-Based Systems and Web Engineering Process** 1.1 The Web & WebApps, Attributes of WebApps and Categories 1.2 Web Engineering and WebE Framework 1.3 Principles for WebE Framework 1.4 The Components of Web Engineering 1.5 Relationship between Software Engineering and WebE 1.6 WebE Process & Agile Methodology, WebE Methods 1.7 Web Engineering Best Practices **Unit 2 Communication Activity Problem Formulation Tasks Requirement Elicitation** 2.1 Stakeholders and User categories 2.2 Tasks before and During Elicitation Session 2.3 Identifying Content and Functional Requirements 2.4 Isolating Constraints and Performance Issues 2.5 Creating Usage Scenarios and usecases 2.6 Identifying WebApp Increments 2.7 Requirement Negotiation **Unit 3 Analysis Modeling for WebApps** 3.1 Introduction - Input, Output, Task, Approaches, User Context 3.2 The Content Model 3.2.1 Structural Element, Information Exchange, Content Objects, Content

	3.2.2 Relationships and Hierarchy, Analysis Classes 3.3The Interaction Model 3.3.1 Sequence Diagram, State Diagrams, Interface Prototypes 3.4 The Functional Model 3.5 The Configuration Model 3.5.1 Relationship-Navigation Analysis **Unit 4 WebApp Design Concepts & Interaction Design** 4.1 Design for WebApps – Logical and Physical Designs, Low and High level design, Deployment design 4.2 Design Goals - Design and WebApp Quality, Design Process 4.3 Initial Designs of Conceptual and Technical Architectures 4.4 Interface Design Principles and Guidelines 4.5 Interface Design Workflow 4.6 Interface Design Preliminaries 4.6.1 Understanding the Characteristics of WebApp Users 4.6.2 Elaborate the Content Objects 4.6.3 Users Tasks eleboration 4.6.4 Design for Different Users 4.7 Interface Design Steps 4.8 Designing Layout and Navigation Mechanism 4.9 Consistency, Aesthetics and Usability design, Design Issues **Unit 5 Information Design and Functional Design** 5.1 Information Architecture Development – Elements and Characteristics 5.2 Information Structures and Blueprints 5.3 Information Accessibility 5.4 Navigation Design: Creating the Detailed Structure 5.5 RMM Model for Navigation Design, WebML for Navigation Design 5.6 WebApp Functionality-its Nature and Categories and Examples 5.7 Functional Design and Functional Architecture, Detailed Functional Design 5.8 Workflow and State Modelling **Unit 6 Construction and Deployment** 6.1 Construction and Deployment within the Process 6.2 Generic Set of Construction Tasks 6.3 Construction Principles and Concepts 6.4 Generic Set of Deployment Tasks 6.5 Deployment Principles 6.6 Version Control and CMS, Construction and the Use of Components **Unit 7 WebApps Testing, Change and Content Management**

	7.1 Testing Concepts, "Dimensions" of Quality, Types of Errors within WebApp Environment Testing Strategy & Test Planning 7.3 Content Testing 7.4 User Interface Testing 7.5 Usability Testing 7.6 Compatibility Testing 7.7 Component-Level Testing 7.8 Navigation Testing- Test Navigation Syntax and Semantics 7.9 Configuration Testing 7.10 Security and Performance Testing 7.11 Load Testing and Stress Testing of WebApps 7.12 Change Management 7.13 Content Management **Unit 8 Current Trends and Future directions in Web Engineering** **Current Trend in Web Engineering Tools and Technologies** 8.1 General Issues in Web Engineering 8.2 Implementation Tools and Technologies , Application Frameworks 8.3 Content Management Systems and Version Control Technologies Search Capability in WebApps 8.4 Development Tools and Technologies 8.4.1 Tools for Modeling Activity 8.4.2 Tools for Testing WebApps 8.4.3 Tools for Management of the WebE Process 8.5 Future Directions 8.5.1 The Changing Nature of the Web and WebApps - Delivery of Web-Based Content and Functionality change 8.5.2 How to Accommodate the Changes? 8.5.3 Web as a Platform for Application Software and OS 8.5.4 Effects of "Semantic Web" 8.5.5 Evolving Web Technologies, Web 2.0 and Web 3.0
Reference Books	1) Web Engineering: A Practitioner's Approach – Pressman and Lowe, Tata McGraw-Hill Publication 2) Software Engineering : A Practitioner's Approach- 6e by Roger S. Pressman, , Tata McGraw-Hill publication. 3) Web Engineering-Rajiv Chopra, PHI publication. 4) Web Site Engineering: Beyond Web Page Design 1st Edition, - Thomas A. Powell , David L. Jones and Dominique C. Cutts 5) Web Engineering: The Discipline of Systematic Development of Web Applications by Gerti Kappel (Editor), Birgit Pröll (Co-Editor), Siegfried Reich Werner Retschitzegger, Wiley Publication

	6) Web Engineering: Modelling and Implementing Web Applications Editors: Rossi, G., Pastor, Ó., Schwabe, D., Olsina, L. (Eds.) – Springer 7) Web Engineering-by Carson Thomas , Larsen and Keller Education, 8) Engineering Web Applications By Casteleyn, S., Daniel, F., Dolog, P., Matera, M., Springer Publication
Teaching Methodology	Discussion, Independent Study, Case study, Seminars and Assignment
Evaluation Method	70% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 30% assessment is based on semester end examination

Elective: Distributed and Parallel Computing

Course Code	
Course Title	**Distributed and Parallel Computing**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	-
Purpose of Course	
Course Objective	
Pre-requisite	NIL
Course Out come	At the end of the course, students will be able to understand the concepts of distributed and parallel computing
Course Content	**Unit 1: Introduction to Distributed systems** 1.1 Various systems and services - Email and Messaging Services, The World wide Web, Social Networking Service, News, Remote Login and File Transfer, Multimedia Transfer 1.2 Distributed Computation Model, Distributed Transaction processing and Ecommerce, Distributed Real-time Processing 1.3 Issues- Naming, Sharing, Availability and Reliability, Replication, Privacy and Security, Communication, Concurrency and Synchronization, Time and Coordination, Fault Tolerance and Recovery, Scalability **Unit 2: Software and Network Architecture for Distributed Systems** 2.1 Software Architecture 2.1.1 Cooperating Processes and Process Groups-Group membership and Message Delivery. 2.1.2 Client-Server and Peer-to-Peer Communication 2.1.3 Component Models, Components and Frameworks 2.1.4 Web Services 2.2 Network Architecture 2.2.1 Functions of layers in OSI Reference Model 2.2.2 Inter connection Networks for Computer Clusters- Time Shared or Common Bus, Crossbar Switch, Multistage Networks, Nearest Neighbor Mesh, Cube Network **Unit 3: Managing Distributed Resources** 3.1 Resource Naming and Addressing-Name Servers, DNS and Directory Services 3.2 Resource Sharing – Sharing primary memory, Distributed Shared memory, Page based DSM, Logical DSM 3.3 Managing Resource Availability and Reliability- concerns in LAN and WAN, Processor and Memory Upgrades and Software Design

3.4 Resource Replication – Replicas as Members of a Group, Reliability of Message Delivery, Message Ordering
3.5 Managing Privacy and Security-Cryptography, Kerberos and Others

Unit 4: Accessing Distributed Resources

4.1 Communication over distributed resources- RPC, Message Passing, Sockets and Streams
4.2 Concurrency while accessing Distributed Resources-Distributed Deadlock and Replica Control
4.3 Coordination of Distributed Resources-Logical and Physical Clocks
4.4 Fault Tolerance and Recovery – Lost messages, Failed Nodes, Partitioning
4.5 Transaction management- Concurrent Transactions, Atomic Transactions, Nested Transaction, The BASE methodology

Unit 5: Major Application areas and Examples

5.1 Distributed File Systems- File Servers, File sharing in P2P, NFS, Coda File System and Google File System
5.2 Distributed Database Systems-Need and Problems/Issues, Parameters for distribution of database, DDBMs structure Queries and Updates in DDBMs, DDBMs support in Microsoft SQL Server and Oracle
5.3 Distributed Operating Systems – Network operating Systems and Distributed Operating Systems, DOS goals and Design issues, DOS-examples- Apache Server and Zookeeper, Amoeba, Mach, Windows NT Family
5.4 Distributed Computation Systems and Grid Computing-
5.4.1 Concerns related to Network platform, algorithm design and implementation and Choice of languages, Standards and Tools
5.4.2 Grid Computing examples -XSEDE, The OptIPuter, TransLight/Global Lambda Integrated Facility
5.5 Internet Driven System examples- Apache Dynamo and DynamoDB, Apache Cassandra, Google's BigTable, BitTorrent, Accessing Replicas in a Distributed Systems
5.6 Other Distributed Systems
5.6.1 Distributed Realtime Systems
5.6.2 Distributed Multimedia Systems

Unit 6: Parallel Processing Architectures

6.1 Need and Concept of Parallel Processing, Application areas of parallel processing, Distributed Memory and Shared Memory Processing, various dependencies and algorithm development for parallel processing
6.2 Parallelism in Sequential Machines- Multiplicity of Functional Units, Pipelining within the CPU, Overlapped CPU and I/O Operations, Hierarchical Memory Systems, Multiprogramming and Timesharing
6.3 Abstract Model of Parallel Computer – P-RAM
6.4 Multiprocessor Architecture, Pipelining and Array Processors, Interconnection Networks

	Unit 7: Parallel Programming Issues 7.1 Parallel Programming Models and Software Tools 7.2 Data Dependency- Types of Dependencies, Loop and Array Dependence 7.3 Program Transformations- Induction variables, Forward Dependency, Backword Dependences, Breaking out of a Loop, Loop Spitting, Loop interchange. 7.4 Overview of Shared Memory Programming and Thread Based Implementation 7.5 Map-Reduce Model of Parallelism **Unit 8: Distributed Computing** 8.1 Message Passing Model for synchronous and asynchronous message passing 8.2 PVM-PVM terminology, Architecture of PVM, Programming Model of PVM, Dynamic Process Groups 8.3 RPC-Parameter Passing and Interface, Locating the Server, RPC Failures And semantics, Security, Disadvantages of RPC, Java RMI example-Remote Interface, Server, Client, Running the code, Garbage Collection, Security 8.4 Distributed Computing Environment-DCE Architecture, DCE Configuration, DCE Directory Services, Distributed File Service, DCE Security Service, DCE Time Service
Reference Books	1. Distributed Systems: Concepts and Design, George Coulouris , Jean Dollimore , Tim Kindberg , Gordon Blair , Pearson, ISBN-10 : 0132143011 2. Distributed Computing: Principles, Algorithms, and Systems, by Ajay D. Kshemkalyani , Mukesh Singhal, Cambridge University Press, ISBN-13 : 978-0521189842 3. Distributed Systems Architecture, Authors: Arno Puder Kay Römer Frank Pilhofer ISBN: 9780080454702, Imprint: Morgan Kaufmann 4. Introduction to Parallel Processing, M.Sasikumar, Dinesh Shikhare, P. Ravi Prakash, PHI Publication, ISBN-13 : 978-8120350311 5. Fundamentals of Parallel Processing, Harry Jordan, Gita Alaghband, Pearson,ISBN-13 : 978-0139011580
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	70% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 30% assessment is based on semester end written examination

Elective: Foundation of Advanced Computing

Course Code	
Course Title	**Foundations of Advanced Computing**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	-
Purpose of Course	The purpose of the course is to make students capable of fundamentals of statistics, mathematics and python programming with advanced libraries.
Course Objective	◆ To learn about fundamental of advanced computing ◆ To learn python programming with advanced libraries
Prerequisite	Basic concepts of Mathematics and Computer Programming
Course Out come	After completion of this course, the student will be capable to understand fundamental concepts statistics, probability , regression, mathematics and operations of computing using python.
Course Content	**Unit 1 Introduction to Statistics** 1.1 Role of Statistics in Computing 1.2 Grouped Data and Mean 1.3 The median and the mode 1.4 Relationship between Mean, Mode, Median 1.5 Data Distribution using Frequency 1.5 Root mean sqaure, Quartiles, Deciles and Percentiles 1.6 Stranded Deviation and Variance 1.7 Software and Measures of Central Tendency 1.8 Overview of Calculus - Differentiation and Integration, Predictions and Cost Functions **Unit 2 Co-Relation Theory and Linear Equations** 2.1 Corelation 2.1.1 Relationship between variables 2.2.2 Corelation Analysis 2.2 Types of Corelation 2.3 Co-efficient of Correlation® and itsInterpretation 2.4 Curve Fitting and Equations 2.5 Non Linear Relationship 2.6 Regression 2.7 Regression Analysis 2.8 Accuracy Measures and Error - RMSE, MSE, MAE **Unit 3 Probability Theory** 3.1 Probability and Conditional Probability 3.2 Events 3.3 Probability Distributions 3.4 Sampling Theory

	3.5 Binomial Distributions **Unit 4 Matrices, Graphs and Tree** 4.1 Matrices as Vectors, Dimension and Rank 4.2 Transpose, Multiplication, Dot Product, Inverse 4.3 Matrices Implementation in Computational Problem Solving 4.4 Graph Definitions, Theory and Elementary Results 4.5Adjacency Matrix and Path Matrix 4.6 Tree Definitions, Binary Tree 4.7 Tree Traversal and Searching **Unit 5 Language, Grammars and Machines** 5.1 Languages and Grammars 5.2 Regular Expression and Regular Languages 5.3 Finite State Automata, Finite State Machines **Unit 6 Python Programming Concepts** 6.1 Python‟s core philosophy 6.2 Jupiter Notebook, Jupyter Lab, basic elements of Python, Objects, Expression and numerical types, Variables and Assignments, IDLE, Branching Programs, String Input, Iteration, Indentation 6.3 Operations on Structured Types-Tuples, Sequence, Lists, Range, Dictionaries 6.4 Functions, Exception and Modules- Difference between Function and Method, Defining Function, Calling Function, Exception handling **Unit 7 Python Libraries : Numpy and SciPy** 7.1 Arrays and Vectorized Computation using NumPy 7.2 NumPy ndarray: A Multidimensional Array Object 7.2.1 Universal Functions: Fast Element-wise Array Functions 7.2.2 Data Processing and File I/O with Arrays 7.3 Scientific Computing and technical computing using SciPy 7.3.1 File Input /Output : scipy.io 7.3.2 Special Functions : scipy.special 7.3.3 Linear Algebra operations: scipy.linalg 7.3.4 Optimize and Fit : scipy.optimize 7.3.5 Statistic and Random Numbers: scipy.stats **Unit 8 Python Libraries : Pandas and Matplotlib** 8.1 Introduction to pandas Data Structures 8.2 Operations on Data 8.2.1 Reading and Writing Data in Text Format 8.2.2 Summarizing and Computing Descriptive Statistics 8.2.3 Handling Missing Data, Combining and Merging Data Sets, Reshaping and Pivoting, Data Transformation, String Manipulation 8.3 Plotting and Visualization 8.3.1 Fundamentals of Matplotlib API 8.3.2 Plotting Functions in Pandas

Reference Books	1. Discrete Mathematics - Sujit Chavan, Nandani Sakhare, HImalaya Publishing House 2. Computer Oriented Statistical Techniques - Dinesh Gabhane, Madhuri S. Banker, HImalaya Publishig HouseLinear Algebra using Python - Archana Jadhav, Nandini Sakhare, Himalya Publishing House 3. Python Data Science FOR Dummies - John Paul Mueller, Luca Massaron - Wiley Publication 4. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, Manning Publication 5. Data Science for Business, Tom Fawcett, Foster Provost , O'relly Publication 6. Python Data Science Handbook, Jake VanderPlas, O'relly Publication 7. Core Python Programming, Nageshwar Rao, dreamtech press
Teaching Methodology	course is composed of readings, assignments and a class project.
Evaluation Method	70% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 30% assessment is based on semester end written examination

Elective: Fundamentals of AI

Course Code	
Course Title	**Fundamentals of AI**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	-
Purpose of Course	The purpose of the course is to make students capable of implementing concepts , methods and tool related to machine learning
Course Objective	• To learn about fundamentals of artificial intelligence • To learn and implement different types of AI concepts.
Prerequisite	Basic concepts of Logic and Reasoning
Course Out come	After completion of this course, the student will be capable to develop models and implement predictive analytics on social media platforms
Course Content	**Unit 1 Introduction to AI** 1.1 Intelligence 1.1.1 Types of Intelligence, Human Vs. Machine Intelligence, 1.1.2 Composition of intelligence - Reasoning, Learning, Problem Solving, Perception, Linguistic Intelligence 1.2 Artificial Intelligence 1.2.1 Philosophy and goals, 1.2.2 AI Technique, Task Classification of AI, Applications of AI 1.3 AI Agents & Environments -Human agent, robotic agent and software agent, ideal rational agent, structure of intelligent agents, Simple Turing test environment, environment properties 1.4 AI-Issues : Threat to privacy, threat to human dignity, threat to Safety **Unit 2 : Problem Solving By Search** 2.1 Problem Formulation and State Space Representation of 8-Puzzle, 8-Queens, missionaries and cannibals problem, Traveling Salesman Problem, Robot Navigation Problem, Water Jug Problem 2.2 Search techniques for Solution Search 2.2.1. Uninformed search strategies, Informed search strategies, 2.2.2 Game Playing Algorithms **Unit 3 : Planning** 3.1 Planning Problem - Air cargo Transport, spare tire problem, the blocks world 3.2 Planning with state space search, Goal stack planning, Plan Space Planning **Unit 4 : Knowledge Representation** 4.1 Knowledge-Based agents, systems & Machine Intelligence 4.2 Overview of Logical and Procedural Representation Schemes and

	Inference 4.3 Structured Representation Schemes - Semantic Network, Description Logic, Ontology, Conceptual Graphs **Unit 5 : Knowledge based Reasoning** 5.1 Procedural Versus Declarative Knowledge 5.2 Logic Programming 5.3 Forward and Backward Chaining 5.4 Reasoning systems for Categories 5.5 Case base Reasoning **Unit 6 : Intelligent Agents** 6.1 AI Intelligent Agents 6.2 Structure of Intelligent Agents 6.3 Agents and Environment 6.4 Types of Agents 6.5 Agent Topology and Agent Architecture **Unit 7 : Real Life Application Areas of AI** 7.1 Expert Systems - Characteristics, Importance, Applications, Examples, Rule based system architecture 7.2 Artificial Neural Network - 7.3 Machine Learning- Classification, Regression, Clustering 7.4 Robotics-Sensors and Effectors, Applications, Robotic Perception, Movement Planning 7.5 Natural Language Processing **Unit 8 : Advanced AI** 8.1 Conversational AI - Bots and REST APIs 8.2 Knowledge Mining 8.3 Autonomous AI 8.4 Responsible AI
Reference Books	1. A First Course in Artificial Intelligence by Deepak Khemani, McGrawHill, ISBN :978-1-25-902998-1 2. Introduction to Artificial Intelligence and Expert System by Dan W. Patterson, PHI, ISBN : 978-93-325-5194-7 3. Artificial Intelligence –A Modern Approach (2nd Edition 2004) by Stuart J. Russell and Peter Norvig, Pearson Education, ISBN: 978-81-775-8367-0 4. Introduction to Artificial Intelligence by Rajendra Akerkar, PHI, ISBN : 978-81-203-2864-8 5. Artificial Intelligence -Structures and Strategies for Complex Problem Solving (4th Edition 2004) by George F. Luger, Pearson Education 6. Foundation of Artificial Intelligence and Expert Systems by V.S. Janakiraman, K. Sarukesi, P. Gopalakrishnan, Mc Millan (2002) 7. Artificial Intelligence: The Basics (Paperback) by Kevin Warwick, Publisher: Routledge 8. The Essence of Artificial Intelligence (Paperback) by Alison Cawsey Publisher: Prentice Hall 9.“Artificial Intelligence” -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw Hill

Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	70% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 30% assessment is based on semester end written examination

Practical

Course Code	
Course Title	**Practical**
Credit	8
Teaching per Week	16 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	-
Purpose of Course	The purpose of the course is to make students capable of implementing concepts, methods, tools and techniques learnt in courses of semester 1.
Course Objective	The objective of these course is to enable students to learn practical implementation of DSC-1, DSC-2, SEC-1 and DSE-1.
Pr-requisite	As per theory papers of semester -1
Course Out come	After completion of this course, the student will be capable of performing practical application of subjects given in semester -1.
Course Content	The students will be required to carry out practical on DSC-1, DSC-2, SEC-1 and DSE-1 using the methods and tools discussed there in. A Journal must be prepared for the practical work done**.**
Reference Book	As per paper DSC-1, DSC-2, SEC-1 and DSE-1.
Teaching Methodology	Lab Work
Evaluation Method	70% Internal assessment is based on Practical attendance, Problem Solving, internal examination etc. 30% assessment is based practical examination at the end of semester.