Proposed syllabus with teaching and evaluation scheme for
1st year (sem 1 and sem 2) study of M.Sc (Computer Application) programme
Proposed to be effective from academic year 2020-21

Master of Science (Computer Application)

Name of Program	Master of Science (Computer Application)
Abbreviation	MSC(CA)
Duration	2 Years (Regular)
Eligibility	Candidate must have passed Bachelors Degree in Computer Science / Computer Application / Information Technology / Computer Engineering / equivalent degree in Computer / IT field.
Objective of Program	The Objective of the program is to impart knowledge of advanced and/or latest theories, concepts, methods, techniques and tools related to various areas of Computer Science, Applications and Information Technology and specifically in the area of Mobile based, cloud based, Web based Application Development, Software Engineering, Data Management and Intelligent Systems.
Program Outcome	At the successful completion of the program, students will be able to start their career in the Information Technology industry.
Program Structure	**Semester 1**

Course Code	Title	Teaching Hrs. per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
101	Advanced Software Engineering / Fundamentals of Artificial Intelligence	4	0	4	3 Hrs	70	30	100
102	Advance Database Management System	4	0	4	3 Hrs	70	30	100
103	Fundamentals of Web Client Technologies.	4	0	4	3 Hrs	70	30	100
104	Enterprise Data Management and ERP / Fundamentals of Big Data	4	0	4	3 Hrs	70	30	100
105	Web Programming Using Java	4	0	4	3 Hrs	70	30	100
106	Practical on Web Programming Using Java	0	4	4	2.5 Hrs	70	30	100
107	Practical on Web Client Technologies	0	3	3	2.5 Hrs	70	30	100
108	Practical on Advanced Database Management System	0	3	3	2.5Hrs.	70	30	100

Course Code	Title	Teaching Hrs. per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
201	Service Oriented Architecture and Cloud Computing	4	0	4	3 Hrs	70	30	100
202	Web Programming Using C#	4	0	4	3 Hrs	70	30	100
203	Advanced Scripting Languages	4	0	4	3 Hrs	70	30	100
204	Data Warehousing and Data Mining Internet of Things	4	0	4	3 Hrs	70	30	100
205	Information Security	4	0	4	3 Hrs	70	30	100
206	Practical on Web Programming Using C#	0	3	3	2.5 Hrs	70	30	100
207	Ppractical on Advanced Scripting Languages	0	4	4	2.5 Hrs	70	30	100
208	Practical on IoT Practical on Cryptography	0	3	3	2.5 Hrs	70	30	100

Semester -2

Course: 101 - Advanced Software Engineering

Course Code	101
Course Title	**Advanced Software Engineering**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make students capable of understanding and implementing advanced software engineering concepts, approaches and methodologies.
Course Objective	To provide a comprehensive knowledge of advanced Software Engineering methodologies and approaches
Pr-requisite	Basic Concept of Software Engineering.
Course Out come	After completion of this course, the student will be capable of following object oriented; component based and/or web engineering practices and model the systems using UML.

Course Content	**1. Object Oriented and Component level Analysis and Design**
	     1.1 Object Oriented Analysis & Design
	        1.1.1 Use case model-identifying & refining actors, scenarios and use cases
	        1.1.2 Classification- Identifying Classes, Object relationships, attributes And Methods.
	        1.1.3 Designing Classes & Components- abstraction, encapsulation, reuse, cohesion, coupling
	     1.2 Component-Based Process Model
	        1.2.1 The CBSE Process
	        1.2.2 Domain Engineering
	        1.2.3 Component-based development
	        1.2.4 Component classification, retrieval and reuse
	
	2. Web Engineering
	     2.1 Attributes of web-based systems and applications, Web Engineering layers, Web Engineering Process
	     2.2 Analysis Model for WebApps
	        2.2.1 Content Model, Interaction Model, Functional Model, Configuration Model,
	        2.2.2 Relationship Navigation Analysis
	     2.3 Design for WebApps
	        2.3.1 Design issues, WebE Design Pyramid,
	        2.3.2 Interface, Asthetic and Content Design
	        2.3.3 Architecture and Navigation Design
	        2.3.4 Component Level Design
	     2.4 Testing WebApps
	        2.4.1 Testing concepts for webApps-quality concepts, Error characteristics, Test planning and Testing strategy, Testing Process

	2.4.2 Overview of Interface Testing, Content Testing, Component-level Testing
	2.4.3 Navigation Testing, Configuration Testing, Security Testing, Performance Testing
	2.5 Project Management for Web Engineering- Outsourcing, In-House Web Engineering.

	3. UML Class and Use-case Diagrams
	3.1 Class Diagram
	    3.1.1 Class Notation-Static Structure
	    3.1.2 Object Diagram
	    3.1.3 Class Interface Notation
	    3.1.4 Incorporating Associations, Association role, qualifier, multiplicity, Association class, Binary and N-ary Associations, aggregation and Composition Associations, Generalization
	3.2 Use case Diagrams
	    3.2.1 Scope, Benefits and Elements
	    3.2.2 Identifying Actors, Scenarios and Use cases
	3.3 A Case Study
	
	4. UML Interaction Diagrams
	4.1 Sequence Diagram - Elements and Guidelines
	4.2 Collaboration Diagram - Elements and Guidelines
	4.3 Activity Diagram - Elements and Guidelines
	4.4 State Chart Diagram - Elements and Guidelines
	4.5 A Case Study
	
	5. UML Implementation Diagrams
	5.1 Component Diagram –Elements & Guidelines
	5.2 Deployment Diagram - Elements & Guidelines
	5.3 A Case Study

Reference Book	1. Software Engineering: A Practitioner's Approach, 6/e, Roger S Pressman TataMcGrawHill 2. Software Engineering: A Practitioner's Approach, 7/e, Roger S Pressman TataMcGrawHill 3. Web Engineering: A Practitioner's Approach, 1/e, Roger Pressman, TataMcGrawHill David Lowe 4. Software Engineering Ian Sommerville Pearson Education (Addison-Wesley) 5. Web Engineering Emila Mendes, New Age Information Nile Mosley (Springer) Publication 6. Object Oriented System Development AliBahrami McGraw Hill 7. Object Oriented Modeling and Design withUML J. Rambaugh, PHI M. Blaha 8. Oriented Software Engineering Ivar Jacobson AWL 9. Applying UML & Patterns: An Introduction to Larman Pearson Education Object Oriented Analysis and Design, 10. Object Oriented Software Engineering using UML Bernd Bruegge, Pearson Education Patterns and Java.Allen H.Dutoit 11. Object Oriented Modeling and Design J. Rambaugh, M. Blaha et

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

Course: 101 - Fundamentals of Artificial Intelligence

Course Code	101
Course Title	**Fundamentals of Artificial Intelligence**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	Artificial Intelligence spans a wide variety of topics at the forefront of computer science research, including areas like machine learning, robotics, planning, computer vision, natural language processing, and many others. This course serves as a broad introduction to many of these topics. It is the goal of this course to study Artificial Intelligence in today's environment and to instill an understanding of representations and external constraints with the idea of enabling a student to think creatively.
Course Objective	**The objectives are as follows:** 1) To give initial exposure of Artificial Intelligence to the students 2) To make student understand AI problems and problem solving approach 3) To make student learn fundamental AI techniques and their applications
Pr-requisite	Students are expected to have substantial experience with programming, Data Structures and Information System
Course Out come	After having completed the course the student will be able to: 1) describe and apply concepts, methods, and theories of search, heuristics, games, knowledge representation, planning & decision making 2) describe and apply concepts, methods, and theories of logic and probability theory and to analyze the power and limitation of their use for knowledge representation and reasoning systems 3) describe methods and theories of Bayesian networks, probabilistic reasoning under uncertainty

Course Content	**Unit 1 Introduction to Artificial Intelligence**
	    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
	    2.3 Planning
	        2.3.1 Planning Problem - Air cargo Transport, spare tire problem,
	          the blocks world
	        2.3.2 Planning with state space search, Goal stack planning,
	          Plan Space Planning
	
	Unit 3 : Knowledge Representation & Reasoning
	    3.1 Knowledge-Based agents, systems & Machine Intelligence
	    3.2 Overview of Logical and Procedural Representation Schemes and
	        Inference
	    3.3 Structured Representation Schemes - Semantic Network,
	        Description Logic, Ontology, Conceptual Graphs
	    3.4 Knowledge based Reasoning
	        3.4.1 Forward and Backward Chaining
	        3.4.2 Reasoning systems for Categories
	        3.4.2 Case base Reasoning
	
	Unit 4 : Decision-Making & **Learning**
	    4.1 Decision-Making
	        4.1.1 Basics of utility theory, Utility Functions
	        4.1.2 Decision Network, Value of Information
	    4.2 Learning
	        4.2.1 Forms of Learning, Inductive Learning, Learning ,
	          Ensemble learning
	        4.2.2 Explanation based Learning, Relevance-based learning,
	          Knowledge-based Inductive Learning
	        4.2.3 Statistical Learning
	
	Unit 5 : Real Life Application Areas of AI
	    5.1 Expert Systems - Characteristics, Importance, Applications,
	        Examples, Rule based system architecture
	    5.2 Artificial Neural Network - Network Structures, Limitations,
	        Perceptrons, Multi-layer Perceptrons, learning ANN structures
	    5.3 Machine Learning- Naive Bayes classifier, Decision Trees, Concept
	        Learning, K-means Clustering
	    5.4 Robotics-Sensors and Effectors, Applications, Robotic Perception,
	        Movement Planning

Reference Book	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 3. Artificial Intelligence -Structures and Strategies for Complex Problem Solving (4th Edition 2004) by George F. Luger, Pearson Education 4. Foundation of Artificial Intelligence and Expert Systems by V.S. Janakiraman, K. Sarukesi, P. Gopalakrishnan, Mc Millan (2002) 6. Artificial Intelligence: The Basics (Paperback) by Kevin Warwick, Publisher: Routledge; 7. The Essence of Artificial Intelligence (Paperback) by Alison Cawsey Publisher: Prentice Hall 8.“Artificial Intelligence” -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw Hill
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 70% assessment is based on end semester written examination

Course Code	102
Course Title	**Advanced Database Management system**
Credit	4 credit
Teaching per Week	4 Hrs
Minimum weeks per Semester	15(Including Classwork, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of understand internal of database system and its architecture
Course Objective	To Provide Comprehensive knowledge of Database Architecture and Administration
Pr-requisite	Basics of Database Design, SQL and Pl/SQL
Course Out come	After completion of this course, the student will gain comprehensive knowledge Database architecture and database administration
Course Content	

Unit -1 SQL/PL/SQL

    1.1 Various SQL statements, Various typed of joins, Nested Subqueries and Complex queries

    1.2 Views, Integrity Constraints, Cursors

    1.3 SQL Functions, Procedures and Triggers

    1.4 Package

    1.5 Collections & Objects

    1.6 Indexes - Simple Index, Composite Index, Bitmap Index, Function Based Index, Key Compressed Index

    1.7 Sequences & Pseudo columns - CURRVAL & NEXTVAL,LEVEL, ROWID, ROWNUM

    1.8 Transaction Control Statements - Commit, Savepoint Rollback

Unit-2 Transaction Management

    2 .1 Transaction Concept & State

    2..2 Implementation of Atomicity and Durability

    2.3 Concurrent Executions

Unit- 3 Overview of Database Server Architecture

    3.1 Architecture of Database and Database Instance

    3.2   Overview of Physical and Logical Structures

    3.3 Dedicated and Shared Server Configuration

    3.4 Server Startup and Shutdown

    3.5 Database   Instance Creation and Management

        3.5.1 Oracle Instance

        3.5.2. Installing Oracle

        3.5.3 Oracle Optimal Flexible Architecture (OFA)

        3.5.4 Locating initialization, listener.ora & sqlnet.orafiles

        3.5.5 Finding the alert log

        3.5.6 Common environment variables

        3.5.7 Structures in an Oracle Instance

	3.5.8 Memory Structures, SGA and PGA
	3.5.9 Processes and their purposes
	3.5.10 Startup nomount, mount and open database commands
	3.6 Database Architecture
	3.7.Database management framework
	3.7.1 Using the Database Creation Assistant
	3.7.2 Creating and dropping a database
	3.7.3 Tablespaces
	3.7.4 Tables and Indexes
	3.7.5 Clusters
	Unit 4 Database Administration and Database User Management
	4.1 User Authentication Methods
	4.1.1 Password Authentication
	4.1.2 O.S Authentication
	4.2 User Configuration Setup
	4.2.1 Profiles
	4.2.2 Default Table space
	4.2.3 Temporary Table space
	4.3 Resource Management, Quotas
	4.4 Working with user database account
	4.4.1 Creating, Modifying and deleting user account
	4.4.2 Changing password
	Unit 5 Database Backup Recovery and security
	5.1 Backup & Recovery
	5.1.1 Types of Backup -Control file, Redo log file, cold and hot backup
	5.1.2 Types of Database failures
	5.1.3 Recovery Methods- Cold Restore, full Database Recovery, Time based recovery
	5.2 Database Security
	5.2.1 Authentication
	5.2.2 Privileged Accounts & Privileges
	5.2.3 Introduction to Object Security and System security
	5.2.4 Database Roles
	5.2.5 Introduction to Database Auditing
Reference Book	1. Database System Concepts, Silberschatz Henry F. Korth and S. Sudarshan McGraw-Hill
	2. Oracle DBA Fundamentals-I - Oracle Press
	3. Effective PL/SQL – Apress
	4. Expert Oracle Database Architecture 9i and 10g, Tom Kyte Apress
	5. Effective Oracle By Design Tom Kyte Oracle Press
	6 Expert Oracle Database 11g Administration, Alpati, Wiley Student Edition
	7. SQL & PL/SQL for Oracle 11g Black Book, Deshpande, Wiley Student Edition
	8. Beginning Oracle Database 11g Administration from novoice to professional, Iggy Fernandez, Apress/Springer
	9. Oracle PL/SQL Example, Rosenweig & Silvestrova 4/e, Pearson Pub
	10. Database Systems Using Oracle: Asimplified guide to SQL & PL/SQL, Shah Nilesh PHI

	11. Learning Oracle SQL & PL/SQL: A Simplified Guide Chatterjee, Rajeeb C PHI
Teaching Methodology	Discussion, Independent Study, Seminars / Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 70% assessment is based on end semester written examination

Course Code	103
Course Title	**Fundamentals of Web Client Technologies**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of course is to make students capable of developing effective and interactive web client part of web applications.
Course Objective	To provide Fundamental knowledge of Web client development technologies
Pr-requisite	Basic understanding of Web, HTTP, HTML, JavaScript and Object Oriented Concepts.
Course Out come	After completion of this course, the student will be capable of developing effective and interactive web client part of web applications.
Course Content	**Unit 1 HTML5** 1.1 Features, Syntax, New tags, standard and custom attributes, events 1.2 Web Form 2.0, Web storage, Web SQL, 1.3 SVG, Canvas, Embedding and Playing Audio & Video, Geo-location **Unit 2 JavaScript** 2.1 JavaScript Language constructs & functions 2.2 Working with Browser Objects-Date, Math, String 2.3 Handling events in JavaScript-Windows event, Event object, Event simulation 2.4 Working with Forms & User Actions 2.5 Working with Windows & Screen objects, 2.6 Working with Document and Navigator Object **Unit 3. Fundamentals of AJAX, JSON and JQuery** 3.1 AJAX Web Application Model, AJAX -need, Advantages and Disadvantages, AJAX Components, AJAX component lifecycle, XMLHttpRequest object, Client Callbacks, The Script Libraries 3.2 Introduction to JSON-Datatypes, Objects, Schema, JSON with Javascript 3.3 Introduction to JQuery- Language Basics, JQuery & DOM - Selectors, Attribute processing , Traversing. JQuery Events, JQuery AJAX , JQuery Utilities, Overview of JQuery UI widgets. **Unit 4. Bootstrap** 4.1 Introduction to Bootstrap, Need, Advantages and Disadvantages 4.2 Grid System, Tables, Forms, Buttons, Images, Helper classes, Responsive Utilities 4.3 Bootstrap Layout Components-Dropdowns, Button Groups, Dropdown Button Groups, Input Groups, Navigation Elements, NavBar, Thumbnails, Pagination, Alerts, Progress bar, List Groups

	4.4 Bootstrap plugins-Transition, Modal, Dropdown, ScrollSpy, Tab, Popover, Collapse, Carousel, Affix

	Unit 5: Introduction to AngularJS
	    5.1 Advantages of Angular JS, Overview of AngularJS lifecycle
	    5.2 Angula JS Concepts & Features -Modules, Scopes, Templates, Directives, Expressions, Controllers, Data Binding, Services, Dependency Injection, Compiler
	    5.3 Integrating AngularJS with existing HTML5, JavaScript and JQuery
	    5.4 Using Global APIs

Reference Book	1. HTML5 Black Book: Covers CSS3, Javascript, XML, XHTML, Ajax, PHP and Jquery, Dreamtech Press 2. WEB TECHNOLOGIES: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML AND AJAX, BLACK BOOK: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book, Dreamtech Press 3. HTML5 and CSS3 made Simple, Ivan Byross, BPB 4. Pro HTML5 and CSS3 Design Patterns, Dionysios Synodinos, Michael Bowers and Victor Sumner, Pearson 5. HTML5 In easy steps, Mike McGrath, McGrawHill 6. Programming in HTML5 with JavaSript and CSS3 Training Guide, Johnson G, PHI 7. JavaScript in easy Steps, Mike McGrath, McGrawHill. 8. AJAX for beginners, Ivan Byros, Sharanam Shah, SPD. 9. AJAX Bible, Steven Holzner, Wiley India 10. AJAX: Creating Web pages, edmond Woychowsky, Pearson 11. jQuery, jQuery UI and jQuery Mobile, Adriaan de Jonge, Pearson 12. Jquery and Jquery UI, Jay Balchand, Pearson 13. Jquery in Action, Dreamtech Press 14. JavaScript and JSON Essentials, Sai Srinivas Sriparasa, Packt Publishing Limited 15. Introduction to JavaScript Object Notation: A To-the-Point Guide to JSON, Lindsay Bassett, SPD 16. Jumpstart Bootstrap, Syed Fazle Rehman , SPD 17. Extending Bootstrap, Christoffer Niska, Packt Publishing 18. AngularJS, JavaScript and JQuery - All in One, Dayley and Dayley, SAMS-Pearson 19. AngularJS, Green and Seshadri, SPD-O'Reilly 20. Professional AngularJS, Karpov and Netto, WROX Publication
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 70% assessment is based on end semester written examination

Course Code	104
Course Title	Enterprise Data Management and ERP
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The course gives students an idea about Enterprise Data Management and ERP
Course Objective	To provide a comprehensive knowledge of the concepts related to Information Systems and modeling of data in these systems.
Pr-requisite	Concept of Information System
Course Out come	After completion of this course, the student will be capable of

Course Content	**Unit 1 Data Management and Information System**
	    1.1 Data Management
	        1.1.1 Hierarchy of Data
	        1.1.2 Data Modeling
	        1.1.3 Data Integrity and Data Quality
	        1.1.5 Metadata
	        1.1.6 Legacy System and Data Migration
	    1.2 Information System
	        1.2.1 Overview of Information System
	        1.2.2 Overview of different types of information systems: MIS,DSS, GDSS,ESS , GIS KSS
	        1.2.3 Impact of Information System on an organisation
	        1.2.4 An Introduction to Electronic Commerce and Mobile Commerce
	        1.2.5 Threats and security to e-commerce and m-commerce
	
	Unit 2 Introduction to ERP
	    2.1 Evolution of ERP and Reasons for the growth of ERP
	    2.2 Scenario and Justification of ERP in India
	    2.3 Various Modules Of ERP
	    2.4 Advantage of ERP.
	    2.5 ERP for Small Business
	    2.6 ERP for make to order companies
	    2.7 Business Process Mapping for ERP Module Design
	    2.8 Hardware Environment and its Selection for ERP Implementation
	
	Unit 3 ERP Products and Modules
	    3.1. Introduction to ERP Products and modules
	    3.2 Finance Module
	    3.3 Plant Maintenance Module
	    3.4 Quality Management Module
	    3.5 Material Management Module

	Unit 4 **ERP implementation lifecycle**
	4.1 Issues in implementing ERP packages
	4.2 Pre-evaluation screening
	4.3 Package evaluation
	4.4 Project planning phase, gap analysis, reengineering,
	4.5 End-user training, post implementation (Maintenance mode).
	4.6 Vendors, Consultants and users, In-House Implementation - pros and cons
	UNIT 5 Business Intelligence
	5.1 Introduction to BI
	5.2 Types of Business Rule
	5.3 Implementing Business Rule
	5.4 Business Re-engineering
	5.5 Overview of Data Warehousing and Data Mining
	5.6 Business Intelligence using Data Warehousing and Data Mining
	5.7 Business Intelligence Applications: Customer Relationship Management, Supply Chain Management.
Reference Book	1.Enterprise Resource Planning By Alexis Leon, TMH
	2.Principles of Information Systems Managerial Approach By Ralph stair and George Reynolds, Thomson Course Technology
	3.Management Information Systems Managing the Digital Firm by Kenneth Laudon and Jane Laudon by PHI
	4.Content Management Bible By Bob Boiko, Wiley Publishing House
	5.Management Information System Text & Application by C.V.S Murthy by Himalaya Publishing House
	6.Management Information System by W.S Jawadekar, TMH
	7.Information System for Modern Management by Murdick Ross and Claget, Prentice Hill
	8.Maximizing your ERP System a Practical guide for Manager by Scott Hamilton, Macgraw Hill
	9.ERP: Make it Happen By Thomas wakace, Willey Publication
	10.ERP : Tools ,Technioques and applications for Integrating the Supply Chain Second Edition by Carl a Ptak, Schragenheim, WIley
	11.Enterprise Sales and Operations Planning by E.Palmatier Coleen H,Ross Publishing
	12. SAP MM Questions and answers by Learning Solutions and Publication Jones Barllet Learning
	13 ERP 100 Sucess secrets By Godfrey
	14 Management Information Systems By Davis and H Olson TMH
	15 Management Information System by Sadopan PHI
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.
	70% assessment is based on end semester written examination

Course Code	104
Course Title	**Fundamentals of BIG DATA**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	To provide comprehensive knowledge about data science and big data
Course Objective	To provide the student sufficient knowledge about fundamental concepts of big data, data analysis and processing.
Pr-requisite	Knowledge about database system and processing concepts
Course Out come	After having completed the course the student will gain: ✓ Understanding of BIG DATA Fundamentals and Principals ✓ Knowledge of Big Data Analysis Process ✓ Technical know-hows about big data processing ✓ Learning of Big Data Technology stack

Course Content	**Unit 1 Understanding Big Data**
	   1.1 Concepts and Terminology -Datasets, Data Analysis & Data Analytics - Descriptive, Diagnostic, Predictive, Perspective
	   1.2 Big Data Characteristics - Volume, Velocity, Variety,Veracity, Value
	   1.3 Different Types of Data- Structured, Semi-Structured, Unstructured, Metadata
	   1.4 Big Data Application and Case Studies
	   1.5 Big Data vs Traditional Data Mining
	
	Unit 2 Big Data Adoption and Planning
	   2.1 Big Data Concerns - Procurement, Privacy, Security, Provenance
	   2.2 Big Data Analytics Lifecyle
	      2.2.1 Business case evaluation
	      2.2.2 Data Acquisition and Filtering
	      2.2.3 ETL Process
	      2.3.4 Data Analysis
	      2.3.5 Data Visualization
	
	Unit 3 Big Data Analysis Techniques
	   3.1 Quantitative Analysis
	   3.2 Qualitative Analysis
	   3.3 Statistical Analysis - A/B Testing, Simple and multiple Corelation, Linear Regression
	   3.4 Machine Learning- Supervised and Unsupervised learning
	   3.5 Semantic Analysis – NLP, Text Analysis, Sentiment Analysis
	   3.6 Visual Analysis – HeatMaps, Time Series Plots, Network Graphs, Spatial Data Mapping

	Unit 4 Big Data Storage related concepts and technologies - 1
	4.1 Clusters
	4.2 File Systems and Distributed File Systems
	4.3 Sharding and Replication
	    4.3.1 Master-Salve Replication
	    4.3.2 Peer-to-Peer Replication4.
	4.4 CAP Therom and ACID vs BASE
	4.5 NoSQL Databases
	    4.5.1 Characteristics and Rationale
	    4.5.2 Types : KeyValue, Document, Coulmn Family, Graph
	4.6 NewSQL Databases
	4.7 In-Memory Databases and Storage Devices
	
	Unit 5 Big Data Storage related concepts and technologies - 2
	5.1 Distributed Data Processing : Hadoop
	5.2 Parallel Data Processing : MapReduce
	5.3 Processing in Batch Mode
	    5.3.1 Batch Processing with MapReduce
	    5.3.2 Map and Reduce Tasks - Map, Combine, Partition,
	        Shuffle and Sort, Reduce
	    5.3.3 A simple Map Reduce Example
	5.4 Understanding MapReduce Algorithms
	5.5 Processing in Real -time Mode

Reference Book:	1. Big Data Fundamentals : Concepts, Drivers & Techniques ,by Thomas Erl, Wajid Khattak, Paul Buhler Publisher :Pearson 2. Big Data : Principal and Practice of scalable real time data systems by Nathan Marz, James Warren Publisher : Dreamtech Press 3. Hadoop The Definitive Guide by Tom White Publisher : O'relliy 4. BIG DATA by Viktor Mayor Schonberger and Kenneth Cukier Publisher : John Murray
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 70% assessment is based on end semester written examination

Course : 105   Web Programming Using JAVA

Course Code	105
Course Title	**Web Programming Using JAVA**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The course gives students an idea about How to use Java in Web Programming
Course Objective	The aim of this course is to provide indepth knowledge about Java Programming Technology
Pr-requisite	Basic Understanding of Web , HTTP, HTML, Programming in Core Java, OOPS concept, DBMS.
Course Out come	After completion of this course, the student will able use JAVA in Web Programming
Course Content	**Unit 1 JAVA WEB ARCHITECTURE** 1.1 The Java Advantage for Web, 1.2 Java EE Web Architecture, 1.3 Java Web Application Servers, **Unit 2 JAVA DATABASE PROGRAMMING** 2.1 The 2-Tier Client Server Architecture 2.2 Java Database Connectivity (JDBC) – API for Accessing Databases 2.3 Database Drivers, Loading a Driver Class 2.4 Connecting the Database Server, 2.5 CRUD operations with Statement Object, PreparedStatement Object, callable statement object 2.6 The ResultSet Object 2.7 Data about Data - The ResultSetMetaData Object 2.8 Handling Database Transactions, Batching the Operations **Unit 3 JAVA SERVLETS** 3.1 Introduction to Java Servlets 3.2 The Java Servlet API 3.3 The Servlet Life Cycle, CGI and Servlets 3.4 Request and Response 3.5 Getting Values from Forms and QueryStrings, 3.6 Working with Databases, Working with HTTP Headers 3.7 Using Hidden Fields 3.9 State Management using cookies and session 3.10 ServletContext and ServletConfig, 3.11 Initalization Parameters, Inter-Servlet Communication with Request 3.12 Dispaching and Forwarding, Filters, Web Listeners 3.13 Writingd deployment Descriptor **Unit 4 JAVA SERVER PAGES** 4.1 Overview of Java Server Pages (JSP) & JSP lifecycle,

	4.2 Directives - Page Directive, Include Directive, Taglib Directive
	4.3 Scripting Elements-Comment Element, Declaration Element,
	     Scriptlets , Expression Element
	4.4 Standard Actions – include, forward, plugins, useBean
	4.5 The Implicit Objects, Handling the HTML Form Submission
	4.6 The Form Validation with Java Bean,
	4.7 State Management, Working with databases
	
	Unit 5 Enterprise Java Beans and Java Application Framework
	    5.1 Stateless Session Bean , Statefull Session Bean,
	    5.2 Binding and looking up objects ,
	    5.3 Singleton Beans, Overview of Message Driven Beans
	    5.4 Local and Remote Lookups,
	    5.5 Asynchronous EJB Methods
	    5.6 WEB SERVICES
	        5.6.1 Types of Web Services
	        5.6.2 Creating, Publishing and consuming RESTFul Web Service
	    5.7 Java Web Application Frameworks
	        5.7.1 Action Based Framework – Overview of SPRING
	        5.7.2 Component Based Framework - JAVA SERVER FACES

Reference Book	1. Head First Servlets and JSP By: Bryan Basham, Kathy Sierra,
	    Bert Bates Publisher: 'Reilly Media
		ISBN 10: 0-596-00540-7 |
		    ISBN 10: 0-596-55633-0
		2. Core Servlets and Javaserver Pages, by Hall and Brown , Sun Micro Sys
		3. Java Servlet & JSP Cookbook by Bruce W. Perry O;reilly
		4. Beginning JSP™, JSF™ and Tomcat™ Web Development: From Novice to
		    Professional by Giulio Zambon and Michael Sekler
		5. Mastering Enterprise JavaBeans and the Java 2 Platform, Enterprise Edition,
		    by Ed Roman
		6. Java 7 EE Tutorial Basic Concepts by Oracle Corporation
		7 Beginning Java™ EE 7 Platform with GlassFish™ 3: From Novice to
		    Professional byAntonio Goncalves
		8 . Beginning EJB 3 Application Development From Novice to Professional
		     by Raghu R.Kodali , Jonathan Wetherbee and Peter Zadrozny, Apress Pub.
		9. Pro JPA 2: Mastering the Java™ Persistence API (Expert's Voice)
		10 Java Technology,by Keith and Schincariol, Apress Pub.

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

Course: 106 - Practical on Web Programming Using Java

Course Code	106
Course Title	Practical on Web Programming Using Java
Credit	4
Teaching per Week	4 hours
Minimum weeks per Semester	15 (including Labwork, Self-Study, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make students capable of implementing concepts, methods and tools learnt in course/paper 105 Web Programming using JAVA.
Course Objective	The Objective of these course is to enable students to develop Full-Stack web application.
Pr-requisite	Programming Skill in Structured and Object Oriented Programming and Core JAVA, Scripting Skills in HTML, Concepts of Networks, Web, HTTP etc.
Course Out come	After completion of this course, the student will be capable of Developing web application in JAVA.
Course Content	The students will be required to carry out practical in Client and Server-side Web Application Development on the topics covered in course/paper 105 Web Programming using JAVA and using the methods and tools discussed there in. A Journal must be prepared for the practical work done**.
Reference Book	As per course/Paper:105
Teaching Methodology	Lab Work
Evaluation Method	30% Internal assessment is based on project presentation and/or demonstration and viva-voice examination. 70% assessment is based Project Presentation and/or demonstration and viva-voice examination at the end of semester.

Course : 107 - Practical on Web Client Technologies

Course Code	107
Course Title	**Practical on Web Client Technologies**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Labwork,examination,preparation,holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make students capable of implementing concepts, methods and tools learnt in course/paper 103 Fundamental of Web Client Technologies .
Course Objective	The Objective of these course is to enable students to develop Client-side web application.
Pr-requisite	Programming Skill in Structured and Object Oriented Programming and Core JAVA, Scripting Skills in HTML, Concepts of Networks, Web, HTTP etc.
Course Out come	After completion of this course, the student will be capable of Developing Full-Stack web application.
Course Content	The students will be required to carry out practical in Client -side Web Application Development on the topics covered in Course/Paper103 Fundamental of Web Client Technologies using the methods and tools discussed there in. A Journal must be prepared for the practical work done**.**
Reference Book	As Per course/paper 103
Teaching Methodology	Lab Work
Evaluation Method	30% Internal assessment is based on Practical attendance, Problem Solving , internal examination etc. 70% assessment is based practical examination at the end of semester.

Course : 108 - Practical on Advance Database Management System

Course Code	108
Course Title	**Practical on Advance Database Management System**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15(Including Labwork, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make students capable of performing DBA related tasks.
Course Objective	The Objective of these course is to enable students to writing Advance SQL queries and PL/SQL blocks , create database instance and carry out basic Data Administration in RDBMS
Pr-requisite	Basic understanding of RDBMS, SQL and PL/SQL
Course Out come	After completion of this course, the student will be able to write Advance SQL queries and PL/SQL blocks , create database instance and carry out basic Data Administration in RDBMS
Course Content	The students will be required to carry out practical on Software Testing on the topics covered in Course/Paper 102: "Advance Relational Database System " using the methods and tools discussed there in. A Journal must be prepared for the practical work done**.**
Reference Book	.As per course/paper 102
Teaching Methodology	Lab Work
Evaluation Method	30% Internal assessment is based on Practical attendance, Problem Solving , internal examination etc. 70% assessment is based practical examination at the end of semester.

Course : 201 Service Oriented Architecture& Cloud Computing

Course Code	201
Course Title	Service Oriented Architecture & Cloud Computing
redit	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 establish foundation of service oriented technologies and cloud computing
Course Objective	To provide comprehensive knowledge of SOA specific technologies, standards and Cloud based systems and aspects related to it.
Pr-requisite	Fundamental knowledge of software engineering, programming, networking, internet and types of Information
Course Out come	After completion of this course, the student will gain comprehensive knowledge of SOA, Cloud based systems and aspects related to it.

Course Content	**Unit 1 Fundamentals of SOA**
	    1.1 Loose Coupling
	        1.1.1 Distributed computing and Problems of interoperability
	        1.1.2 Hardware, Software, and Network Transparency
	        1.1.3 XML for openness, flexibility and loose coupling
	    1.2 Services
	        1.2.1 Line of business services, Reusable Technical Services, Service contracts, Service requesters and Service Providers
	        1.2.2 Service characteristics
	    1.3 Need, Characteristics, Benefits and Limitations of SOA
	        1.3.1 Overview of SOA Principles and guidelines
	        1.3.2 Characteristics of SOA
	        1.3.3 Technical Benefits of SOA
	        1.3.4 Challenges introduced by SOA
	
	Unit 2 Introduction to SOA & Web Services
	    2.1 Infrastructure Services
	        2.1.1 Resource Virtualization Service
	        2.1.2 Service-Level Automation and Orchestration
	        2.1.3 Utility Business Services.
	    2.2 Web Service Technologies-SOAP, WSDL, UDDI
	    2.3 Service Level Interaction Patterns
	    2.4 Integration & Interoperability using XML and Web services
	        2.4.1 Web Services Integration(WSI)
	        2.4.2 Service-oriented Integration(SOI)
	        2.4.3 .Net and J2EE Interoperability
	    2.5 Multi channel Access
	        2.5.1. Business benefits of Multichannel Access
	        2.5.2. SOA Architecture for Multi-channel Access

	2.6 Overview of Web Service Security.

	Unit 3 Fundamentals of Cloud Computing
	    3.1 Introduction to Web 2.0 and Web3.0
	    3.2 Virtualization
	    3.3 Moving towards Cloud Computing
	    3.4 Cloud characteristics and challenges
	    3.5 Cloud Computing Essentials
	        3.5.1 Cloud Computing Architectural Framework
	        3.5.2 Cloud Deployment Models and Service Models
	        3.5.3 Virtualization in Cloud Computing
	        3.5.4 Parallelization in Cloud Computing
	    3.6 Relationship between Cloud and SOA
	
	Unit 4Cloud Service Models & Cloud Based Systems
	    4.1 Infrastructure as a Service(IaaS)
	        4.1.1 Server virtualization
	        4.1.2 Storage virtualization
	        4.1.3 Network virtualization
	    4.2 Platform as a Service(PaaS)
	        4.2.1 Azure
	        4.2.2 GooleAppEng
	        4.2.3 Hadoop
	        4.2.4 SalesForce
	    4.3 Software as a Service (SaaS)-Characteristics, Open SaaS and
	        SOA
	        4.3.1 Cloud services
	        4.3.2 Web portal
	        4.3.3 Web OS
	Unit 5 Cloud Service Models & Cloud Based Systems
	    5.1 Cloud Based Storage
	        5.1.1 Provisioning Cloud Storage - Unmanaged and Managed
	            cloud storage, creating cloud storage systems, virtual
	            storage containers.
	        5.1.2 Cloud Backup solutions-types, features, cloud attached
	            backups.
	        5.1.3 Cloud storage Interoperability- Cloud Data
	            Management Interface(CDMI), Open cloud
	            Computing Interface(OCCI)
	    5.2 Cloud Based Productivity Software
	        5.2.1 Productivity applications and Characteristics
	        5.2.2 Online Office systems- Acrobat.com, GoogleDocs,
	            Microsoft Office Weapps etc.
	    5.3 Security in public cloud.

Reference Book	1. Pro Newcomer & Lomow, "Understanding SOA with Web Services", Pearson Education, 2007 2. Bieberstein,Bose,Fiammante,Jones and Shah "Service-Oriented Architecture(SOA) Compass", Pearson Education, 2010 3. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005. 4. Thomas Erl, "SOA: Principles of Service Design ",Pearson Education, 2009

	5. Pulier and Taylor, "Understanding Enterprise SOA", DreamTech, 2008
	6. Michael HAvey, "SOA cookbook", SPD, 2008
	7. Cloud Computing: Principles and Paradigms - R. Buyya et al-Wiley 2010
	8. Cloud Computing Bible - Sosinsky - Wiley - India,2011
	9. Cloud Computing Second Edition Dr. Kumar Saurabh - Wiley - India, 2012
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 70% assessment is based on end semester written examination

Course : 202 - Web Programming using C#

Course Code	202
Course Title	**Web Programming using C#**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make students capable of developing professional applications using latest tools and technologies of C#.Net.
Course Objective	To provide an in-depth knowledge of most recent server side programming technology.
Pr-requisite	Basic understanding of Web, HTTP, HTML, JavaScript, Programming in .Net and Object Oriented Concept, DBMS.
Course Out come	After completion of this course, the student will be capable of developing professional applications using latest tools and technologies of C#.Net.

Course Content	**Unit 1 ASP.NET using C#**
	   1.1 Life cycle of ASP.Net Application on IIS & Lifecycle of ASP.Net Web Page
	   1.2 Structure of Application- Application Domain, Application Lifetime, Application Directory Structure
	   1.3 Client & Server Side State Management-Application State, Session State, ViewState, Cookies.
	   1.4 Postback and Cross-page Posting
	
	Unit 2 Working with Data
	  2.1 Working with ADO.NET
	  2.2 Database Operations – SqlDataSource, XmlDatasource
	  2.3 Data Access with LINQ
	     2.3.1 Introduction of LINQ
	     2.3.2 LinqDataSource control
	     2.3.3 LINQ to Dataset
	     2.3.4 Overview of LINQ to SQL
	  2.4 Overview of ADO.Net Entity Framework
	
	Unit 3: Advanced Server Controls
	   3.1 Data Binding with Controls
	   3.2 Website Navigation Controls
	   3.3 Server-side Ajax-ScriptManager, UpdatePanel, Timer, UpadateProgress
	
	Unit 4 ASP.Net MVC Application
	   4.1 Introduction to ASP.Net MVC Framework
	   4.2 Building an MVC page
	   4.3 CRUD operation in MVC

	Unit 5 Web Service and Cloud programming with C#
	5.1 Overview of ASP.Net Web Services
	5.2 Fundamental of WCF
	5.3 Service Endpoints
	5.4 Service Contract, Operation Contract and Data Contract
	5.5 WCF service instance management
	5.6 Restful WCF Services
	5.6 Introduction to WebAPI
	5.7 Fundamentals of programming for Google/Microsoft Azure Cloud
Reference Book	1. Pro ASP.NET 4 in C# 2010– Matthew MacDonald – Apress
	2. ASP.NET 4.0 Unleashed – Stephen Walther – Sams
	3. Professional ASP.NET 3.5: In C# and VB (Programmer to Programmer)– by Bill Evjen – Wrox
	4. Beginning ASP.NET 3.5 in VB 2008– Matthew MacDonald – Apress
	5. ASP.Net 4.0 Black Book – dreamtech press
	6. Essential Windows Communication Foundation(WCF) : For .Net Framework 3.5 - Steve Resnick - Pearson
	7. ASP.Net 4 Unleased - SAMS-Pearson
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.
	70% assessment is based on end semester written examination

Course: 203 - Advanced Scripting Languages

Course Code	203
Course Title	**Advanced Scripting Languages**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	To provide comprehensive knowledge about JavaScript-based framework built on Google Chrome's JavaScript V8 Engine
Course Objective	To provide knowledge on how to develop I/O intensive web applications like video streaming sites, single-page applications, and other web applications using Node.js framework
Pr-requisite	Basic understanding of JavaScript, HTML, CSS and AJAX
Course Out come	After having completed the course the student will gain: ✓ Understanding of Node.js Environment ✓ Knowledge of Node Modules ✓ Technical know-hows of Full Stack Node.js based development ✓ Application of Node.js web development of real life application

Course Content	**Unit 1 Introduction Node.js**
	 1.1 Features and Applications
	   1.1.1 Installing Node, Node Hosting Environments
	   1.1.2 Node Building Blocks- Global and Process objects, buffers,
	        Typed arrays and Strings, Streams, Callbacks and Asynchronous
	         Event Handling- Event Queue, Event Emitter, Event Loop and
	         Timers, Nested Callback and
	 1.2 Exception Handling.
	 1.3 REPL Terminal
	
	 Unit 2 Node Modules and Node Package Manager (NPM)
	  2.1 Overview of Node Module System
	  2.2 Overview of Node Package Manager
	  2.3 Creating and Publishing Node Modules
	  2.4 Node Modules-Async, Commander and Underscore, OAuth
	  2.5 Overview of Other Utility Modules
	
	 Unit 3 Node with the Local System and the Web
	   3.1 Streams and Pipes
	   3.2 Node and the File System- The fs.Stats class, The File
	      System Watcher, File Read and Write, Directory access
	      and Maintenance, File Streams
	   3.3 Resource Access with Path
	   3.4 The HTTP Module: Server and Client
	      Using APACHE to proxy a Node Application
	      Query String Parsing and DNS Resolution

	Unit 4 Full-Stack Node development
	    4.1 The Express Application Framework
	    4.2 Working with MongoDB-writing data, querying, Indexes,
	        MapReduce
	    4.3NODE.JS RESTful API
	
	Unit 5 Node in New Environment
	    5.1 SamsungIoT and GPIO
	    5.2 Windows with Chakra Node
	    5.3 Node for Microcontrollers and Microcomputers Fritzing
	    5.4 Node and Adruino
	    5.5 Node and Raspberry Pi

Reference Book	1. Learning Node Moving to the server side Shelley Powers O'Relly SPD Publication 2. Buliding Node Applications with MongoDB and Backbone Mike Wilson O'Relly SPD Publication 3. GEO, CouchDB & NodeJS Mick Thompson O'Relly SPD Publication
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 70% assessment is based on end semester written examination

Course Code	204
Course Title	Data Warehousing & Data Mining
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of understanding and implementing concepts and techniques related to data warehousing and data mining.
Course Objective	To provide a comprehensive knowledge of Data Warehousing and different Data Mining Techniques
Pr-requisite	Basic Concept of RDBMS, Information System, OLTP
Course Out come	After completion of this course, the student will be capable to carry out data warehousing related activities, data preprocessing, data mining and analysis

Course Content	**Unit -1 Introduction to Data warehousing**
	1.1 Data Warehouse characteristics
	1.2 Data Marts
	1.3 Applications of Data Warehousing
	1.4 OLTP and OLAP systems
	1.5 Star schema, Multifact star schema or snow flake schema, Fact Constellation schema
	1.6 OLAP Operations in the Multidimensional data model
	1.7 OLAP servers & Tools
	1.8 Building a Data Warehouse
	1.9 Metadata Repository
	
	Unit -2 Introduction to Data Mining
	2.1 Importance of and Motivation behind data mining
	2.2 Data mining process and knowledge discovery
	2.3 Introduction to Data Mining techniques
	2.4 Data Pre-processing-Cleaning, Integration and Transformation, Reduction, Discretization etc.
	2.5 Major issues in Data Mining
	
	Unit -3 Classification and Prediction
	3.1 Introduction and Applications of classification
	3.2 Data Preparation for classification and prediction
	3.3 Classifier types with their advantages and limitations
	    3.3.1 Decision tree Model based classifier
	    3.3.2 Decision tree Induction-based classifier
	    3.3.3 Rule based classifier
	3.4 Measures for Attribute selection -Info.Gain, GINI Index, Entropy, Classification error
	3.5 Overview of various classification algorithms(J48, ID3, C4.5)

	Unit 4 Clustering
	4.1. Introduction and Applications of clustering
	4.2. Types of Data Variables in clustering-Interval scaled, Binary, Nominal, Ordinal, RatioScaled
	4.3. Categorization of Major clustering Methods
	4.4. Partitioning Methods - *k*-Means and *k*-Medoids
	4.5. Introduction other clustering methods- Hierarchical Clustering, Agglomerative Clustering, Density based Clustering Methods, Grid-Based Clustering, Model Based Clustering
	Unit -5 Association Rule Mining & Other Data Mining Techniques
	
	5.1 Basic concepts and Roadmap for association rule mining and its Applications
	
	5.2 Overview of Apriori and FPGrowth Algorithms for Association Rule Mining
	
	5.3 Other Data Mining Techniques
	
	    5.3.1 Data Prediction-Linear regression based prediction
	    5.3.2 Outlier Analysis- Statistical based, Distance based, Deviation based
	    5.3.3 Conceptual Techniques- Data characterization and Generalization, Data Comparison or Discrimination

Reference Book	1. Data Warehouse Toolkit R. Kinball JohnWiley & Sons 2. Decision Support and Data Warehouse Systems Efrem G. Mallach TMH 3. Data Warehousing Fundamentals PaulrajPulliah Wiley 4. Data Warehousing in the real world S. Anahory& D. Murray Addison Wesley 5. The Data Warehouse Lifecycle Toolkit R. Kinball, L.Reeves Mosley JohnWiley &Sons 6. Principles of Data Mining David Hand, HeikkiMannila,Padhraic SmythPHI 7. Data Warehousing C.S.R.PrabhuPHI 8. Data Mining Next Generation Challenges & Future Directions HillolKargupta, AnupamJoshi, Yelena Yesha, Krishnamoorthy Sivakumar PHI 9. Data Mining Concepts & Techniques Jiawei Han, MichelineKamber 10. Data Mining Introductory and Advanced Topics Dunham Pearson 11. Data Mining Techniques and Trends N.P Gopalan, B. Sivasalvan PHI
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 70% assessment is based on end semester written examination

Course Code	**204**
Course Title	**Internet of Things**
Credit	4
Teaching per Week	4 Hrs
Medium of Instruction	English
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of this course is to impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things, IoT applications and examples overview (building automation, transportation, healthcare, industry, etc.)
Course Objective	This course is an introduction for students to IoT. The course also gives students an idea about various components of IoT and explains the working of them. The course also explains the role of embedded systems in IoT ecosystem.
Pr-requisite	Fundamental knowledge of Computer Organization, Computer Networks and Internet, Basic programming knowledge
Course Out come	After having completed the course the student will gain: 1. Understanding about the architectural detail of IoT 2. Exposure to working with Arduino & Raspbery pi 3. Knowledge about domain specific applications of IoT

Course Content	**Unit 1: Introduction to The Internet of Things**
	    1.1 The Internet of Things overview - History of IoT, Components of IoT, Charcteristics of IoT, About Objects/things in IoT
	    1.2 Enabling Technologies of IoT
	        1.2.1 Cloud Computing
	        1.2.2 Big Data Analytics
	        1.2.3 Wireless Sensor Networks
	        1.2.4 Embedded systems
	        1.2.5 Communication protocols
	    1.3 Near Field Communication & RFID
	
	Unit2: IoT Architecture
	    2.1 M2M to IoT
	        2.1.1. Introduction of M2M - Components of M2M
	        2.1.2. Difference between IoT and M2M
	    2.2 IoT Reference Model or physical design and logical design of IoT
	    2.3 IoT Reference Architecture
	
	Unit 3: Arduino
	    3.1 Introduction to Arduino
	    3.2 Flavours of Arduino
	    3.3 Architecture of Arduino board

	3.4 Getting started with Arduino
	    3.4.1 Installing Arduino Desktop IDE
	    3.4.2 Installing Board drivers, Configuring board type, uploading the program
	
	3.5 Hardware interfacing & programming
	    3.5.1. LED on/off using timer
	    3.5.2. Arduino alarm system which detects movement of an intruder with a high pitched alarm sounds and flashing lights.
	    3.5.3. Arduino Trafiic Light Controller
	
	Unit 4 : Raspberry pi
	4.1 About the board
	4.2 Linux on Raspberry pi
	4.3 Raspberry pi interfaces of Data Transfer
	4.4 Reading general purpose Input/Output pin
	4.5 Hardware interfacing & programming
	    4.5.1 Controlling LED with Raspberry pi
	    4.5.2 Interfacing a light sensor(LDR) with Raspberry pi
	
	Unit 5: IoT Application Areas and Security Concerns
	5.1 IoT Application Areas
	    5.1.1. Home Automation
	    5.1.2. Smart Cities
	    5.1.3. Smart Energy & Smart Grid
	    5.1.4. Smart Health
	    5.1.5. Smart Manufacturing
	    5.1.6. Smart Agriculture
	5.2 IoT - Security risks and challenges

Reference Book	1. IoT & Applications I.A. Dhotre Technical Publication 2. Designing the Internet of Things Adrian McEwen and Cassimally Wiley 3. The Internet of Things Connection objects to web Edited by Hakima Chauchi Wiley 4. Introduction to Embedded System -By Shibu K V , McGrawHill 5. Getting Started with Internet of Things –By Cuno Pfister, O'Reilly 6. Learning Internet of Things-By Peter Waher , Packt Publication 7. Internet of Things : A Hands on Approach – By Arshdip Bahga and Vijay Madisetti 8. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press) 9. Raspberry Pi User Guide –By Eben Upton and Garath Halfacree, Wiley 10. Raspberry Pi for Dummies , Wiley 11. Raspberry Pi IoT in C -By Harry Fairhead, I/O Press
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 70% assessment is based on end semester written examination

Course Code	205
Course Title	Information Security
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of understanding and implementing concepts and techniques related to information security.
Course Objective	To provide a comprehensive knowledge of security issues and cryptography
Pr-requisite	Fundamentals of Operating Systems and Computer Networks
Course Out come	After completion of this course, the student will be capable to understand security issues and their solutions

Course Content	**Unit 1 Security Basics**
	    1.1 Computer Security , Information Security , Threat and Attacks and Malicious Logic
	    1.2 Countermeasures
	    1.3 Security Policies , Confidentiality Polices and Integrity Policies
	    1.4 Operating System Security
	        1.4.1 Security Risks at Common Ports and Services , File Systems and Resources & user accounts
	        1.4.2 Operating System Hardening
	
	Unit 2 Network and other securities
	    2.1 Common network security Incidents and Attacks
	    2.2 Threat and attack at Boundary Devices and their defences
	    2.3 Firewall Implementation as a defence mechanism
	    2.4 VPN Implementation as a defence mechanism
	    2.5 Intrusion Detection and Prevention Implementation as a defence mechanism
	    2.6 Web related threats, attacks and defence mechanism
	    2.7 Database related threats, attacks and defence mechanism
	    2.8 Wireless network related threats, attacks and defence mechanism
	    2.9 Security in e-commerce, m-commerce-issues and solutions
	
	Unit 3. Symmetric Ciphers
	    3.1 Overview of basic encryption techniques (Caesar cipher, zebra technique, vinegar cipher, transposition cipher, play fair cipher, rail fence cipher, hill cipher)
	    3.2 Block Cipher
	    3.3 DES, Triple DES, AES

	3.4 Contemporary Symmetric Cipher

	Unit 4. Asymmetric encryption
	    4.1 Use of Number Theory
	    4.2 Public-key Cryptography
	    4.3 RSA
	    4.4 Authentication Protocols
	        4.4.1 Message authentication and hash function
	        4.4.2 Hash algorithms - MD5 , SHA1
	        4.4.3 Digital signatures
	        4.4.4 SSL
	
	Unit 5 Secure Application level Protocols
	    5.1 SMIME
	    5.2 SFTP
	    5.3 PGP
	    5.4 Steganography
	    5.5 HTTPS (SSL)

Reference Book	1. Computer Security: Art and Science, Matt Bishop Addison-Wesley 2. Introduction to Computer Security Matt Bishop Addison-Wesley 3. Information security William Stallings 4. Cryptography and Public Key Infrastructure on the Internet Klaus Schmeh Willey 5. Beginning Cryptography with Java David Hook Wrox 6 Information Security-Theory and Practices Dhiren Patel PHI 7 Cryptography and Network Security, Fourth William Stallings Edition
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 70% assessment is based on end semester written examination

Course: 206 - Practical on Web Programming Using C#

Course Code	206
Course Title	**Practical on Web Programming Using C#**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make students capable of implementing concepts, methods, tools and techniques of Web Programing learnt in course/paper **202** Web Programming Using C#
Course Objective	The Objective of these course is to enable students to develop Full-Stack web application in C#.
Pr-requisite	Programming Skill in Structured and Object Oriented Programming and Core C#, Scripting Skills in HTML, Concepts of Networks, Web, HTTP etc.
Course Out come	After completion of this course, the student will be capable of developing web application using c# and related tools and technologies.
Course Content	The students will be required to carry out practical in Client and Server-side Web Application Development on the topics covered in course/**Paper 202 Web Programming using C#** using the methods and tools discussed there in. A Journal must be prepared for the practical work done**.**
Reference Book	As per course/Paper:202
Teaching Methodology	Lab Work
Evaluation Method	30% Internal assessment is based on Practical attendance, Problem Solving, internal examination etc. 70% assessment is based practical examination at the end of semester.

Course: 207 - Practical on Advanced Scripting Languages

Course Code	207
Course Title	**Practical on Advanced Scripting Languages**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make students capable of implementing concepts, methods, tools and techniques of Scripting Languages learnt in course/paper **203 Advanced Scripting Languages**
Course Objective	The Objective of these course is to enable students to develop application in Advanced Scripting Languages.
Pr-requisite	Programming Skill in Structured and Object Oriented Programming, Scripting Skills in HTML and JavaScript, Concepts of Networks, Web, HTTP etc.
Course Out come	After completion of this course, the student will be capable of developing application based on course/paper **203 Advanced Scripting Language** and related tools and technologies.
Course Content	The students will be required to carry out practical in Scripting Languages on the topics covered in course/**Paper 203 Advanced Scripting Language** using the methods and tools discussed there in. A Journal must be prepared for the practical work done**.**
Reference Book	As per course/Paper:203
Teaching Methodology	Lab Work
Evaluation Method	30% Internal assessment is based on Practical attendance, Problem Solving, internal examination etc. 70% assessment is based practical examination at the end of semester.

Course: 208 - Practical on IoT

Course Code	208
Course Title	**Practical on IoT**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make students capable of implementing concepts, methods, tools and techniques of cryptography learnt in course/paper **204 Internet of Things**
Course Objective	The Objective of this course is to enable students to write programs for various microcontrollers and build IoT applications.
Pr-requisite	Basic understanding of computer organization and working of microprocessor, Programming in C language. Student must have opted the course **204-Internet of Things** in the same semester in which student opts for this course.
Course Out come	After completion of this course, the student will be capable of developing IoT applications.
Course Content	The students will be required to carry out practical programming on various microcontrollers and on the topics covered in course/Paper 204: Internet of Things using C/C++/ Raspberry PI/Java/C#/Node JS languages. A Journal must be prepared for the practical work done**.**
Reference Book	As per course/Paper:204
Teaching Methodology	Lab Work
Evaluation Method	30% Internal assessment is based on Practical attendance, Problem Solving, internal examination etc. 70% assessment is based practical examination at the end of semester.

Course: 208 - Practical on Cryptography

Course Code	208
Course Title	**Practical on Cryptography**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make students capable of implementing concepts, methods, tools and techniques of cryptography learnt in course/paper **205 Information Security**
Course Objective	The Objective of this course is to enable students to apply various cryptographic algorithms.
Pr-requisite	Basic understanding of Programming and Algorithms, Programming in C language.
Course Out come	After completion of this course, the student will be capable of performing various types of cryptography.
Course Content	The students will be required to carry out practical programming of various basic cryptography techniques on the topics covered in course/Paper 205: "**Information Security**" using C/C++/Java/C# languages. A Journal must be prepared for the practical work done**.**
Reference Book	As per course/Paper:205
Teaching Methodology	Lab Work
Evaluation Method	30% Internal assessment is based on Practical attendance, Problem Solving, internal examination etc. 70% assessment is based practical examination at the end of semester.