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VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Fax : +91 - 261 - 2227334
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

ક્રમાંક : એકે./પરિપત્ર/૫૮૩૬/૨૦૨૦
તા. ૧૬/૦૭/૨૦૨૦

પ્રતિ,
વડાશ્રી,
ડિપાર્ટમેન્ટ ઓફ કોમ્પ્યુટર સાયન્સ,
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી,
સુરત.

વિષય :– એમ.સી.એ.(M.C.A.3rd Year)સેમેસ્ટર – ૫ અને ૬ અભ્યાસક્રમ અને Teaching and Evaluation Scheme અંગે.

સુજ્ઞશ્રી,

સવિનય જણાવવાનું કે, શૈક્ષણિક વર્ષ–૨૦૨૦–૨૧ થી અમલમાં આવતા એમ.સી.એ.(M.C.A.3rd Year)સેમેસ્ટર – ૫ અને ૬ અભ્યાસક્રમ અને Teaching and Evaluation Schemeબાબતે ચર્ચા કરતા કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસસમિતિની તા.૧૯/૧૧/૨૦૧૯ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે નીમેલ પેટાસમિતિએ તૈયાર કરેલ અભ્યાસક્રમ અને ટીચિગ ઈવેલ્યુએશન સ્કીમ અભ્યાસસમિતિનાં ચેરમેનશ્રીએ અભ્યાસસમિતિવતી મંજૂર કરી ફેકલ્ટીને કરેલ ભલામણ કોમ્પ્યુટર સાયન્સ એન્ડ ઈન્ફોર્મેશન ટેકનોલોજી વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલે તેની તા. ૩૦/૦૬/૨૦૨૦ ની સભાના ઠરાવ ક્રમાંક : ૧૦૨ અન્વયે મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્ઉપરાંત તેનો અમલ કરવો.

એકેડેમિક કાઉન્સિલની તા.૩૦/૦૬/૨૦૨૦ ની સભાનાં ઠરાવ ક્રમાંકઃ ૧૦૨

:: આથી ઠરાવવામાં આવે છે કે, કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસસમિતિએ તેની તા.૧૯/૧૧/૨૦૧૯ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે નીમેલ પેટાસમિતિએ તૈયાર કરેલ તેમજ કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસસમિતિનાં ચેરમેનશ્રીએ અભ્યાસસમિતિવતી અને કોમ્પ્યુટર સાયન્સ એન્ડ ઈન્ફોર્મેશન ટેકનોલોજી વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિદ્યાશાખાવતી મંજૂર કરેલ શૈક્ષણિક વર્ષ–૨૦૨૦–૨૧ થી અમલમાં આવતા એમ.સી.એ.(M.C.A.3rd Year) સેમેસ્ટર – ૫ અને ૬ અભ્યાસક્રમ અને Teaching and Evaluation Scheme મંજૂર કરવામાં આવે છે.

R. B. R. A.
ઈ.ચા.કુલસચિવ

બિડાણ : ઉપર મુજબ

પ્રતિ,

૧) અધ્યક્ષશ્રી, કોમ્પ્યુટર સાયન્સ એન્ડ ઈન્ફોર્મેશન ટેકનોલોજી વિદ્યાશાખા
૨) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

...તરફ જાણ તેમજ અમલ સારૂ.

Veer Narmad South Gujarat University

Teaching and Evaluation Scheme

MCA 5th Semester (Web Group)

Course Code	Title	Teaching per week		Course Credits	University Exam		Internal Exam	Total Marks
		Theory	Practical		Duration	Marks		
501	Unix Internals & Shell Programming / Internet of Things	4	0	4	3 Hrs	70	30	100
502	Artificial Intelligence and Knowledge Based Systems	4	0	4	3 Hrs	70	30	100
503	Advanced Java Programming / Advanced Web Technologies	4	0	4	3 Hrs	70	30	100
504	Advanced iOS Development with Swift / NoSQL Databases	4	0	4	3 Hrs	70	30	100
505	Open Source Web Based Programming	4	0	4	3 Hrs	70	30	100
506	Programming Skills XI	0	2	2	2 Hrs	70	30	100
507	Programming Skills XII	0	3	3	2 Hrs	70	30	100
508	Programming Skills XIII	0	2	2	2 Hrs	70	30	100
509	Programming Skills XIV	0	3	3	2 Hrs	70	30	100

MCA 5th Semester (Database Group)

Course Code	Title	Teaching per week		Course Credits	University Exam		Internal Exam	Total Marks
		Theory	Practical		Duration	Marks		
501	Unix Internals & Shell Programming / Internet of Things	4	0	4	3 Hrs	70	30	100
502	Artificial Intelligence and Knowledge Based Systems	4	0	4	3 Hrs	70	30	100
503	ERP Using SAP / NoSQL Databases	4	0	4	3 Hrs	70	30	100
504	Advanced Database Administration	4	0	4	3 Hrs	70	30	100
505	Data Warehousing and Data Mining / Big Data	4	0	4	3 Hrs	70	30	100
506	Programming Skills XI	0	2	2	2 Hrs	70	30	100
507	Programming Skills XII	0	3	3	2 Hrs	70	30	100
508	Programming Skills XIII	0	2	2	2 Hrs	70	30	100
509	Programming Skills XIV	0	3	3	2 Hrs	70	30	100

MCA 5th Semester (Network Group)

Course Code	Title	Teaching per week		Course Credits	University Exam		Internal Exam	Total Marks
		Theory	Practical		Duration	Marks		
501	Unix Internals & Shell Programming / Internet of Things	4	0	4	3 Hrs	70	30	100
502	Artificial Intelligence and Knowledge Based Systems	4	0	4	3 Hrs	70	30	100
503	Network Essential & its Security	4	0	4	3 Hrs	70	30	100
504	Network Administration	4	0	4	3 Hrs	70	30	100
505	Wireless Network & Mobile Computing	4	0	4	3 Hrs	70	30	100
506	Programming Skills XI	0	2	2	2 Hrs	70	30	100
507	Programming Skills XII	0	3	3	2 Hrs	70	30	100
508	Programming Skills XIII	0	2	2	2 Hrs	70	30	100
509	Programming Skills XIV	0	3	3	2 Hrs	70	30	100

MCA 5th Semester (General Group)

Course Code	Title	Teaching per week		Course Credits	University Exam		Internal Exam	Total Marks
		Theory	Practical		Duration	Marks		
501	Unix Internals & Shell Programming / Internet of Things	4	0	4	3 Hrs	70	30	100
502	Artificial Intelligence and Knowledge Based Systems	4	0	4	3 Hrs	70	30	100
503	Network Essential & its Security	4	0	4	3 Hrs	70	30	100
504	Advanced Database Administration	4	0	4	3 Hrs	70	30	100
505	Open Source Web Based Programming	4	0	4	3 Hrs	70	30	100
506	Programming Skills XI	0	2	2	2 Hrs	70	30	100
507	Programming Skills XII	0	3	3	2 Hrs	70	30	100
508	Programming Skills XIII	0	2	2	2 Hrs	70	30	100
509	Programming Skills XIV	0	3	3	2 Hrs	70	30	100

MCA 6th Semester

Teaching and Evaluation Scheme

Paper	Title	Credits	University Exam Marks	Internal Exam Marks	Total Marks
601	Seminar	6	70	30	100
602	Project	24	280	120	400

MCA 5th Sem. (Web Group)

Course: 501: **Unix Internals & Shell Programming**

Course Code	501
Course Title	**Unix Internals & Shell Programming**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of implementing the concepts, methods and tools of Unix internals & Shell Programming
Course Objective	The objective of the course is - 1. Acquaint the student with the Unix Operating System 2. shell programming and Internals of the Unix O.S.
Pre-requisite	Operating Systems, Programming Skills
Course Out come	After completion of this course, the student will be capable to develop, manage and maintain Unix & shell based programming. The student will be capable of working with Unix OS.
Course Content	**Unit -1 Introduction & Overview of Unix OS** 1.1 Features of UNIX 1.2 System Structures 1.3 Shell and Its Features 1.4 Kernel 1.4.1 Architecture of the UNIX OS 1.4.2 Kernel Data Structures 1.5 Logging in & out 1.6 Inode & File Structure 1.7 File System Structure & Features 1.8 Booting Sequence & Init process 1.9 File Access Permission **Unit-2 Shell programming & Advanced Shell programming** 2.1 Basic Shell Programming 2.1.1 Environment & User defined Variables 2.1.2 Argument processing 2.1.3 Shell's Interpretation at prompt 2.1.4 Arithmetic Expression Evaluation 2.1.5 Control Structures 2.1.6 Redirection 2.1.7 Background Process & Priorities of Process 2.1.8 Conditional Execution 2.1.9 Parameter & quote substitution 2.1.10 Command Evaluation & Command Grouping 2.1.11 Trapping Signals 2.2 Advanced Shell Programming & Utilities 2.2.1 Filtering Utilities – sed 2.2.2 awk 2.2.3 Batch Processes 2.2.4 Splitting, Comparing, Sorting, Merging and Ordering Files 2.2.5 Terminals Handling 2.2.6 Communication with Other Users 2.2.7 Spooling and Print Management 2.2.8 Backup and Recovery 2.2.9 Remote Login, File Transfer & sharing

	Unit-3 File System & Internal Representation 3.1 Structure of Buffer Pool 3.2 Superblock 3.3 Inode assignment to file 3.4 Reading, writing and allocation of disk blocks 3.5 System calls for File System **Unit-4 Process Management** 4.1 Status and Transitions 4.2 Context and manipulation of process address space 4.3 Process creation and termination 4.4 Process scheduling 4.5 System calls for process management 4.6 Inter Process Communication **Unit-5 Memory Management & I/O Subsystem** 5.1 Swapping 5.2 Demand Paging 5.3 System Calls for memory management 5.4 Solution with semaphore 5.5 The I/O Subsystem 5.5.1 Driver interface 5.5.2 Disk and terminal drivers 5.5.3 Streams **Self Study :** Sockets programming.
Reference Books	1. The Design of UNIX OS, M.J. Bach, Prentice Hall 2. UNIX for Super-Users, Eric Foxley, Addision Wesley 3. The UNIX Programming Environment by Brian W. Kernighan, Pike Prentice Hall of India 4. UNIX Network Programming , The Socket Networking API Vol. 1 by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff Prentice Hall of India 5. UNIX Network Programming, Interpocess Communication Networking API Vol.2. by W. Richard Stevens PHI 6. C and UNIX Programming by N. Kutti Tata McGraw Hill 7. UNIX Shells – Bourne, Korn & C Vijay Mukhi BPB Publication
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30 % internal assessment and 70% external assessment

Course: 501: **Internet of Things (IoT)**

Course Code	501
Course Title	**Internet of Things (IoT)**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course is an introduction for students to IoT. The course also gives students an idea about various components of IoT and explain its working. The course also explains the role of embedded systems in IoT ecosystem.
Course Objective	The objective of the course is - 1. To make student understand IoT 2. To understand the working of Micro-Controller & Micro-Computer 3. To explain various types of sensors 4. To introduce students with Programming in IoT
Pre-requisite	C , C++, PHP
Course Outcome	After studying this, student will be able to understand how Micro-Controller & Micro-Computer works. This course will also help students to appreciate the role of embedded systems in IoT environment. After successful completion, students will be able to work with different types of Micro-Controllers, Micro-Computers and sensors for their IoT based application development.
Course Content	**Unit 1: Internet of Things (IoT)** 1.1 Introduction to IoT 1.1.1 IoT Today 1.1.2 IoT Vision 1.2 IoT Architecture 1.2.1 Elements of IOT Ecosystem 1.3 IoT Related Standards and Protocols 1.4 Industrial Applications of IoT 1.5 IoT Privacy, Security & Governance 1.5.1 Identification in Distributed Environment 1.5.2 Device Authentication 1.5.3 Data Correlation and Information Retrieval 1.6 IOT Botnet **Unit 2: Sensors** 2.1 Introduction to Sensors 2.2 Types of Sensors & their work 2.3 Wireless Sensor Network **Unit 3: Micro-Controller: Arduino, NodeMCU** 3.1 What is a Micro-Controller? 3.2 Architecture of Microcontroller: 8051 3.3 Role of Microcontrollers in IoT 3.4 Introduction to Arduino 3.5 Working with Arduino IDE 3.6 NodeMCU 3.6.1 Features and Wireless capability 3.6.2 Difference between Arduino and NodeMCU 3.7 Interacting with Sensors & Micro-Controller **Unit 4: Micro-Computer: Raspberry Pi** 4.1 What is a Micro-Computer? 4.2 Difference between Micro-Controller and Micro-Computer

	4.3 Introduction to Pi family 4.4 Configuring Pi for IoT 4.5 Interacting with Sensors & Raspberry Pi **Unit 5: IoT Application Development** 5.1 Server side Development 5.2 Client side Development 5.3 Peer to Peer Interaction 5.4 IoT Interaction through Mobile Apps
Reference Books	1) Introduction to Embedded System – By Shibu K V , McGrawHill 2) Microcontrollers – Architecture, Programming, Interfacing and system design – By Raj Kamal , Pearson 3) Exploring C for Microcontrollers : A hands on approach, Springer 4) 8051 Microcontrollers an Application based Introduction, Elsevier 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) Raspberry Pi User Guide – By Eben Upton and Garath Halfacree, Wiley 9) Raspberry Pi for Dummies , Wiley 10) Microprocessor Architecture, Programming and Applications with the 8085 - By Ramesh Gaonkar , Penram International Publishing 11) Raspberry Pi IoT in C – By Harry Fairhead, I/O Press 12) Arduino for Dummies, Wiley 13) Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media 14) ESP8266: Get Started With ESP8266 Programming NodeMCU Using Arduino IDE, Createspace Independent Pub 15) Internet of Things Projects with ESP32, Packt Publishing Limited
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 502: **Artificial Intelligence and Knowledge Based Systems**

Course Code	502
Course Title	**Artificial Intelligence and Knowledge Based Systems**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of implementing the concepts, methods and tools of Artificial Intelligence and learn their implementation in Knowledge Based Systems
Course Objective	To acquaint students with concepts of Artificial Intelligence and its applications.
Pre-requisite	Data Structures, Information Systems
Course Outcome	After completion of this course, the students will be capable to use various Artificial Intelligence techniques in various applications.
Course Content	**Unit 1: Introduction to Artificial Intelligence** 1.1. What is AI 1.2. Applications of AI 1.3. Introduction to Expert System 1.4. Applications of expert systems **Unit 2: Knowledge Overview** 2.1. Definition and importance of knowledge 2.2. Overview knowledge representation 2.3. Overview of knowledge organization 2.4. Overview of knowledge Manipulation 2.5. Overview of Knowledge Acquisition **Unit 3: Representation and Search** 3.1. Structured Knowledge 3.1.1. Associative networks 3.1.2. Frame structures 3.1.3. Conceptual dependencies and scripts 3.2. Object oriented representation **Unit 4: Organization and Manipulation, Knowledge Acquisition** 4.1. Introduction to organization 4.2. Search techniques 4.2.1. Uninformed search 4.2.2. Informed search 4.2.3. Introduction to matching Techniques 4.3 Knowledge Acquisition 4.3.1. Knowledge learning types 4.3.2. General learning models 4.3.3. Performance of learning models **Unit 5: Expert System** 5.1. Advantages of Expert Systems 5.2. Characteristics of Expert Systems 5.3. Design of Expert Systems 5.3.1. Selecting Problem 5.3.2. Stages in Expert systems development 5.3.3. Errors in developments

	5.3.4. Expert System Software Engineering 5.3.5. Expert System Life Cycle
Reference Books	1. Introduction to Artificial Intelligence and Expert System by Dan W. Patterson, PHI (1999) 2. Artificial Intelligence – A Modern Approach (2nd Edition 2004) by Stuart J. Russell and Peter Norvig, Pearson Education 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) 5. Expert Systems Principles and Programming (3rd Edition) by Giarratano & Riley, Thomson (Vikas Pulishing House) 6. Introduction to Artificial Intelligence by Rajendra Akerkar, PHI
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 503: **Advanced Java Programming**

Course Code	503
Course Title	**Advanced Java Programming**
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	This course is advance level java course to learn web & web enabled application development using Java Technologies.
Course Objective	To develop web application skills using Java web technology
Pre-requisite	Core Java, Object oriented Programming
Course Outcome	After studying this students will be able to understand how to develop web application. This course will also help students to know various java web servers available. After successful completion students will be able to develop web applications using java.
Course Content	**Unit 1: Java Database Connectivity(JDBC)** 1.1 Types of JDBC Drivers 1.2 Connecting to databases like Access, MySQL, SqlServer, Oracle 1.3 Interacting with Database using SQL Queries 1.4 JDBC Objects: Connection, Resultset, Statement, Metadata 1.5 More JDBC Objects: DataSource, RowSet, RowSet events 1.6 Calling Stored Procedures 1.7 Managing Transactions 1.8 JDBC Connection Pooling 1.9 Handling Errors/Warning **Unit 2: Java Servlets** 2.1 Introduction to Servlets 2.2 Servlet Lifecycle 2.3 Handling HTTP GET and POST requests 2.4 Invoking other web resources 2.5 Maintaining client state 2.6 Servlet 3.0 Annotations 2.7 Servlet Filter 2.8 File Upload **Unit 3: Java Server Pages(JSP), JSTL (Standard Tag Library) & EL** 3.1 Introduction to JSP, page lifecycle 3.2 JSP Elements – directives, scriplet, action 3.3 Implicit JSP objects 3.4 Using JavaBeans in JSP, Session Tracking 3.5 JSTL – Using Java Standard Tag Library 3.6 JSTL Core & Database tags 3.7 Introduction to EL (Expression Language) 3.8 EL implicit objects **Unit 4: Web Services with XML & JSON** 4.1 Introduction to Web Services 4.2 Building XML based web services with JAX-WS 4.3 Building Restful web services with JAX-RS 4.4 Reading/Writing XML files in Java (JAXP) 4.5 Introduction to AJAX

	Unit 5: JPA & MVC Introduction 5.1 Introduction to Java Persistence API (JPA) 5.2 Entity Beans & Session Beans 5.3 Overview of MVC Framework 5.4 Spring Architecture 5.5 Spring XML Configuration 5.6 Aspect oriented programming
Reference Books	1. Java EE Tutorial Basic Concepts by Oracle Corporation 2. Beginning Java™ EE Platform with GlassFish™ : From Novice to Professional by Antonio Goncalves 3. Beginning EJB 3 Application Development From Novice to Professional by Raghu R.Kodali and Jonathan Wetherbee with Peter Zadrozny, Apress Publication 4. Pro JPA 2: Mastering the Java™ Persistence API 5. Head First Servlets and JSP By: Bryan Basham, Kathy Sierra, Bert Bates Publisher: 'Reilly Media 6. Core Servlets and Javaserver Pages: Author Marty Hall , Larry Brown, Sun Micro System 7. Java Servlet & JSP Cookbook by Bruce W. Perry O;reilly Publication 8. Beginning JSP™, JSF™ and Tomcat™ Web Development: From Novice to Professional by Giulio Zambon and Michael Sekler 9. JAVA Complete Reference , TMH Publication 10. Professional Java Development with Spring Framework , 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 semester end University External examination

Course: 503: **Advanced Web Technologies**

Course Code	503
Course Title	Advanced Web 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	To teach ASP .Net for web application development
Course Objective	To impart knowledge of web application development using ASP .Net
Pre-requisite	Fundamental of .Net framework and HTML desirable
Course Out come	Students will be able to development web application using ASP .Net
Course Content	**Unit : 1 : Introduction to .NET Framework, C# and ASP.NET** 1.1. NET Architecture 1.2. C# Language 1.3. Page Class 1.4. Web Configuration files 1.5. Exception Handling 1.6. Logging Exceptions 1.7. Error Pages 1.8. Page Tracing 1.9. View State, Query String 1.10.Cookie , Session 1.11.Application , Global.asax **Unit : 2 : ASP.NET Controls** 2.1 Web Controls 2.1.1 Common Web Server Controls 2.1.2 Specialized Web Server Controls 2.1.3 Table, Image, FileUpload 2.1.4 PostBack / Auto PostBack 2.2 Validation and Rich Controls 2.3 Website Navigation Controls - Sitemap, Treeview, Menu Controls 2.4 ASP.NET AJAX Controls 2.4.1 Introduction 2.4.2 Server Callbacks / Script Manager 2.4.3 ASP.NET AJAX Server Controls 2.4.4 UpdatePanel **Unit : 3 : ASP .NET Web Application with Database** 3.1. ADO.NET Architecture 3.2. Direct Data Access 3.3. Disconnected Data Access 3.4. Data Binding & Data Controls 3.4.1. Single-view, Repeated-Value, Data Source 3.4.2. Gridview - Formatting, Edit, Sorting, Paging, Templates 3.4.3. Detail View, Form View 3.4.4. Data Repeater Control 3.5. Introduction to LINQ **Unit : 4 : ASP .NET - XML, WEB Services, MVC** 4.1. XML Basics 4.2. Web Services

	4.2.1. Architecture 4.2.2. Web Service Creation and Implementation 4.3. MVC Framework 4.3.1. Models 4.3.2. Controllers 4.3.3. Views 4.4. Introduction to Caching **Unit : 5 : Web API and .NET Core** 5.1. Introduction to JSON 5.2. Web API 5.3. API Creation and Consumption 5.4. Introduction to .NET Core 5.5. Micro services in .NET Core
Reference Book	1. Professional ASP.NET, Wrox Publication 2. ASP.NET – From Novice to Professional, Wrox Publication 3. ASP.NET Bible, By Mridula Parihar 4. Beginning ASP.NET 4.5, Wrox Publication 5. Programming Microsoft ASP.NET, Microsoft Press 6. Beginning AJAX with ASP.NET, Wrox Publication 7. Professional ASP.NET MVC 5, Wrox Publication 8. Professional C# 7 and .NET Core 2.0 , Wrox Publication 9. ASP.NET Core 2 Fundamentals, Packt Publication 10. Pro ASP.NET MVC 5, Apress 11. Programming ASP.NET Core, Microsoft Press 12. Pro C# 7 with .NET and .NET Core, Apress
Teaching Methodology	Classroom, seminar and assignment
Evaluation Method	As per University rules

Course: 504: **Advanced iOS Development with Swift**

Course Code	504
Course Title	**Advanced iOS Development with Swift**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course will help the students to understand the fundamental as well as advanced concepts of iOS Programming. The course also provides them the skills necessary to develop an iOS Application from scratch to deploying it on the App Store.
Course Objective	The objective of the course is - 5. To understand the iOS ecosystem and tools for creating iOS applications 6. To explain advanced level concepts in iOS application design and development 7. To impart knowledge of Swift programming language
Pre-requisite	Knowledge of C, C++ and SQL
Course Outcome	After studying the course, students will be able to understand how iOS applications are created and deployed using Swift language. They will also be able to create advanced level, database/Web Services driven applications.
Course Content	**Unit 1: Introduction to iOS ecosystem** 1.1 Introduction to Xcode IDE a. Environment setup b. Editors, Storyboard and Simulator 1.2 Application Life-Cycle 1.3 View Controller Life-Cycle 1.4 Info.plist and App Permissions 1.5 MVC in iOS 1.6 Introduction to iOS App Frameworks a. Foundation Framework b. UIKit Framework c. Swift and SwiftUI **Unit 2: Introduction to Swift Programming Language** 2.1. Simple Values – Constant and Variable 2.2. Control Flow 2.3. Functions and Closures 2.4. Objects and Classes 2.5. Enumerations and Structures 2.6. Protocols and Extensions 2.7. Error Handling 2.8. Generics **Unit 3: UIKit: View Controllers, Views and Controls** 3.1 Text Views: UILabel, UITextField, UITextView 3.2 Controls: UIButton, UIDatePicker, UIPageControl, UISegmentedControl, UISlider, UIStepper, UISwitch 3.3 Content Views: UIActivityIndicatorView, UIImageView, UIPickerView, UIProgressView 3.4 Bars: UINavigationBar, UISearchBar, UIToolbar, UITabBar 3.5 Images and Video: UIImagePickerController 3.6 Container View Controllers: UINavigationController, UITabBarController 3.7 Container Views: Table Views, Collection Views 3.8 Alerts: UIAlertController

	3.9 Gestures: UITapGestureRecognizer, UIPinchGestureRecognizer, UIRotationGestureRecognizer, UISwipeGestureRecognizer, UIPanGestureRecognizer **Unit 4: Data Persistence and Networking** 4.1. UserDefaults 4.2. FileManager 4.3. SQLite Framework 4.4. Core Data Framework 4.5. JSON Parsing 4.6. Working with URL and URL classes **Unit 5: App Services and App Deployment** 5.1. Core Motion – Accelerometer, Gyroscope, Pedometer, Magnetometer, Altitude 5.2. Core Location – CLLocationManager, CLLocation, Authorization 5.3. MapKit – Map Fundamentals, Map Coordinates, Annotations and Overlays 5.4. How to deploy an Ad-Hoc app – (diawi) 5.5. Publishing an app to the AppStore
Reference Books	1. Apple Documentation [developer.apple.com/documentation] 2. The Swift Programming Language by Apple Inc. [swift.org/documentation] 3. Hacking with Swift by Paul Hudson [hackingwithswift.com] 4. iOS 13 Programming Fundamental with Swift by Matt Neuberg, O'Reilly 5. Programming iOS 13 by Matt Neuberg, O'Reilly 6. Mastering Swift 5: Deep dive into the latest edition of the Swift programming language, 5th Edition, Packt Publishing Limited 7. Swiftui Essentials - IOS Edition: Learn to Develop IOS Apps Using Swiftui, Swift 5 and Xcode 11 by Neil Smyth, Payload Media, Inc. 8. Beginning iOS 13 & Swift App Development: Develop iOS Apps with Xcode 11, Swift 5, Core ML, ARKit and more by Greg Lim 9. Pro iPhone Development with Swift 5: Design and Manage Top Quality Apps by Wallace Wang, Apress
Teaching Methodology	Class work, Discussion, Self-study, Seminars and/or 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 semester end University External examination

Course: 504: **NoSQL Databases**

Course Code	504
Course Title	**NoSQL Databases**
Credit	4
Teaching per Week	4
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	To teach the emerging trends in NoSQL databases
Course Objective	To impart knowledge of NoSQL Databases
Pre-requisite	Fundamentals of DBMS
Course Outcome	Students will be able to learn NoSQL databases – namely MongoDB and Cassandra
Course Content	**Unit 1: Introduction** 1.1 History 1.2 Concepts and Characteristics of NoSQL databases 1.3 Primary benefits of NoSQL databases **Unit 2: MongoDB** 2.1 SQL/NoSQL landscape 2.2 Document Vs. Other types of Storage 2.3 MongoDB feature set 2.4 Introduction to BSON and JSON 2.5 MongoDB Architecture 2.6 Documents and Collections 2.6.1 Creating Documents 2.6.2 Managing Documents in collections 2.6.3 Iterating over Documents 2.7 Queries 2.7.1 Simple Queries 2.7.2 Complex Queries 2.7.2.1 Existential field values 2.7.2.2 Aggregations and groups 2.7.2.3 Aggregations and groups in hierarchical data 2.8 Updates and Deletes 2.9 Updates and Arrays 2.10 Indexing 2.11 MongoDB RESTful API 2.12 MongoDB Security 2.13 MongoDB Replication and Sharing 2.14 Introduction to MapReduce **Unit 3: Cassandra** 3.1 Cassandra Architecture 3.1.1 Cassandra P2P Architecture 3.1.2 Clustering Structures- Nodes 3.1.3 Rings 3.1.4 Virtual Nodes 3.1.5 Consistency & Hashing 3.1.6 Gossip Protocol 3.1.7 Data Replication 3.1.8 Replication Factors & Indexes 3.1.9 Tunable Consistency 3.1.10 High & Rapid Scalability Memtables, SStables & Commitlogs

	3.1.11 Repairs 3.1.12 Tombstones 3.1.13 Repairs 3.1.14 Replication Factors 3.1.15 Compaction and Anti-Entropy 3.1.16 Bloom Filters 3.2 Data Modelling in Cassandra 3.3 Cassandra Administration 3.4 CQL3 3.5 Integration with Hadoop
Reference Books	1. Chodorow, K. (2013). MongoDB: The Definitive Guide (2nd ed.). Upper Saddle River, NJ: Pearson Education, Inc. ISBN-13: 978-1449344689 ISBN-10: 1449344682. 2. Shashank Tiwari, Professional NoSQL, Sierra Nevada Books, ISBN-13: 978-0470942246 3. Amol Nayak, Instant MongoDB, Packt Publishing Limited, 2013, ISBN-13**:** 978-1782169703 4. Kristina Chodorow, MongoDB Definitive Guide 2e, O'Reilly, 2013, ISBN-13: 978-1449344689 5. Eben Hewitt, Cassandra Definitive Guide, O'Reilly, 2010, ISBN:ISBN 10:1-4493-9041-2
Teaching Methodology	Classroom, seminar 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 semester end University External examination

Course: 505: **Open Source Web Based Programming**

Course Code	505
Course Title	**Open Source Web Based Programming**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to understand fundamentals of Open Source web based Programming. The course also imparts students learning about Open source web based scripting language PHP and Mysql database. It also includes MVC or Three tier architecture of web based programming and Javascript technology like ReactJS.
Course Objective	Student will learn fundamentals and advance topics of Open source Web technology
Pre-requisite	Knowledge of HTML, Javascript and SQL
Course Out come	After studying the course, students will be able to understand how Open source web technology works. They will also be able to create database driven Websites.
Course Content	**Unit 1 : Introduction to Open source Web based Programming** 1.1 Introduction to PHP & MySql 1.2 Installation of PHP and MySql 1.3 Language Characteristics & Features 1.4 Operators and Variables, Control Structures, Looping and Error handling 1.5 PHP functions 1.5.1 String Functions 1.5.2 Array Functions 1.5.3 Mathematical Functions 1.5.4 Graphics Library (GD Support) 1.5.6 Date and Time Functions 1.5.7 Misc. Function 1.6 State management Techniques 1.7 Object Oriented Features of PHP 1.7.1 Classes and Objects 1.7.2 Use of constructors 1.7.3 Serialization 1.7.4 Inheritance **Unit 2 : MySQL database server** 2.1 Configuring the MySQL Server 2.2 MySQL Tables, Displaying MySQL Database , Adding and removing user access 2.3 Database connection and data processing functions **Unit 3 : Advance PHP** 3.1 Ajax Basics 3.1.1HTTP Request and Response Fundamentals 3.1.2 The XMLHttpRequest Object XMLHttpRequest Methods 3.1.3 XMLHttpRequest Properties 3.1.4 Cross-Browser Usage Sending a Request to the Server 3.1.5 PHP and Ajax Client-Driven Communication 3.1.6 Server-Side Processing Expanding and Contracting Content 3.1.7 Form Validation 3.1.8 Ajax-Based Database Querying 3.2 XML 3.3 Web services

	Unit 4 : MVC 4.1 Introduction to MVC 4.2 CodeIgniter: Introduction, Features and Application Flow Chart 4.3 Controller 4.4 Views 4.5 Models 4.6 Helpers 4.7 Creating and Usage of Libraries and Helpers 4.8 URL Routing 4.9 Error Handling 4.10 Profiling Application **Unit 5 : Introduction to React JS** 5.1 What is React JS 5.2 Environment Setup 5.3 JSX and ES6 5.4 Components 5.5 Props and State 5.6 Components API and Lifecycle 5.7 Forms and Events 5.8 Difference between React JS and React Native
Reference Books	1. Beginning PHP, Apache, MySQL Web Development - Elizabeth Naramore, Jason Gerner , Yann Le Scouarnec,Jeremy Stolz,Michael K. Glass, Gary Mailer – Wrox Publication 2. Professional PHP Programming - Jesus Castagnetto ,Wrox Press Ltd 3. Beginning PHP and MySQL: From Novice to Professional - W. Jason Gilmore, Apress 4. Php: The Complete Reference - Steven Holzner, Tata Mcgraw Hill Education Private Limited 5. AJAX and PHP: Building Responsive Web Applications - Bogdan Brinzarea, Cristian Darie packtpub 6. CodeIgniter for Rapid PHP Application Development - David Upton ,packtpub 7. Professional CodeIgniter- Thomas Myer, Wrox Press Ltd 8. Learning React - Kirupa Chinnathambi , Paperback – 2018 9. Mastering React- Adam Horton and Ryan Vice, packtpub 10. Php manual – www. Php.com
Teaching Methodology	Class work, Discussion, Self Study, Seminars and/or 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 semester end University External examination

Course: 506: **Programming Skills XI**

Course Code	506
Course Title	**Programming Skills XI**
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement the Unix Internals with shell programming/IOT practically.
Course Objective	Learning to implement fundamentals and advanced topics of Unix Internals with Shell Scripting/IOT practically
Pre-requisite	Practical programming in desktop environment / Embedded Technology
Course Outcome	After studying the course, students will be able to practically work on advanced technology platforms of Unix Internals with Shell Scripting /IOT.
Course Content	Practical based on paper no 501. Separate journal to be prepared for this subject based on 501.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 507: **Programming Skills XII**

Course Code	507
Course Title	**Programming Skills XII**
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement the advanced concepts of .NET/Java practically.
Course Objective	Learning to implement the advanced topics of .NET/Java practically.
Pre-requisite	Practical programming in basic .NET/Java.
Course Outcome	After studying the course, students will be able to practically work on advanced technology platforms of .NET/Java.
Course Content	Practical based on paper no 503. Separate journal to be prepared for this subject based on 503.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 508: **Programming Skills XIII**

Course Code	508
Course Title	**Programming Skills XIII**
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement the advanced concepts of iOS/NoSQL Databases, practically.
Course Objective	Learning to develop and deploy apps using iOS/NoSQL Databases practically.
Pre-requisite	Practical programming in basic iOS/NoSQL Databases.
Course Outcome	After studying the course, students will be able to practically work on advanced technology platform of iOS/NoSQL Databases.
Course Content	Practical based on paper no 504. Separate journal to be prepared for this subject based on 504.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 509: **Programming Skills XIV**

Course Code	509
Course Title	**Programming Skills XIV**
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement the basic and advanced concepts of PHP/MySql practically.
Course Objective	Learning to develop and deploy websites using PHP/MySql practically.
Pre-requisite	Basic scripting, programming, html.
Course Outcome	After studying the course, students will be able to practically develop dynamic websites using PHP/MySql.
Course Content	Practical based on paper no 505. Separate journal to be prepared for this subject based on 505.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

MCA 5th Sem. (Database Group)

Course: 501: **Unix Internals & Shell Programming**

Course Code	501
Course Title	**Unix Internals & Shell Programming**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of implementing the concepts, methods and tools of Unix internals & Shell Programming
Course Objective	The objective of the course is - 1. Acquaint the student with the Unix Operating System 2. shell programming and Internals of the Unix O.S.
Pre-requisite	Operating Systems, Programming Skills
Course Out come	After completion of this course, the student will be capable to develop, manage and maintain Unix & shell based programming. The student will be capable of working with Unix OS.
Course Content	**Unit -1 Introduction & Overview of Unix OS** 1.1 Features of UNIX 1.2 System Structures 1.3 Shell and Its Features 1.4 Kernel 1.4.1 Architecture of the UNIX OS 1.4.2 Kernel Data Structures 1.5 Logging in & out 1.6 Inode & File Structure 1.7 File System Structure & Features 1.8 Booting Sequence & Init process 1.9 File Access Permission **Unit-2 Shell programming & Advanced Shell programming** 2.1 Basic Shell Programming 2.1.1 Environment & User defined Variables 2.1.2 Argument processing 2.1.3 Shell's Interpretation at prompt 2.1.4 Arithmetic Expression Evaluation 2.1.5 Control Structures 2.1.6 Redirection 2.1.7 Background Process & Priorities of Process 2.1.8 Conditional Execution 2.1.9 Parameter & quote substitution 2.1.10 Command Evaluation & Command Grouping 2.1.11 Trapping Signals 2.2 Advanced Shell Programming & Utilities 2.2.1 Filtering Utilities – sed 2.2.2 awk 2.2.3 Batch Processes 2.2.4 Splitting, Comparing, Sorting, Merging and Ordering Files 2.2.5 Terminals Handling 2.2.6 Communication with Other Users 2.2.7 Spooling and Print Management 2.2.8 Backup and Recovery 2.2.9 Remote Login, File Transfer & sharing

	Unit-3 File System & Internal Representation 3.1 Structure of Buffer Pool 3.2 Superblock 3.3 Inode assignment to file 3.4 Reading, writing and allocation of disk blocks 3.5 System calls for File System **Unit-4 Process Management** 4.1 Status and Transitions 4.2 Context and manipulation of process address space 4.3 Process creation and termination 4.4 Process scheduling 4.5 System calls for process management 4.6 Inter Process Communication **Unit-5 Memory Management & I/O Subsystem** 5.1 Swapping 5.2 Demand Paging 5.3 System Calls for memory management 5.4 Solution with semaphore 5.5 The I/O Subsystem 5.5.1 Driver interface 5.5.2 Disk and terminal drivers 5.5.3 Streams **Self Study :** Sockets programming.
Reference Books	1. The Design of UNIX OS, M.J. Bach, Prentice Hall 2. UNIX for Super-Users, Eric Foxley, Addision Wesley 3. The UNIX Programming Environment by Brian W. Kernighan, Pike Prentice Hall of India 4. UNIX Network Programming , The Socket Networking API Vol. 1 by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff Prentice Hall of India 5. UNIX Network Programming, Interpocess Communication 6. Networking API Vol.2. by W. Richard Stevens PHI 7. C and UNIX Programming by N. Kutti Tata McGraw Hill 8. UNIX Shells – Bourne, Korn & C Vijay Mukhi BPB Publication
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30 % internal assessment and 70% external assessment

Course: 501: **Internet of Things (IoT)**

Course Code	501
Course Title	**Internet of Things (IoT)**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course is an introduction for students to IoT. The course also gives students an idea about various components of IoT and explain its working. The course also explains the role of embedded systems in IoT ecosystem.
Course Objective	The objective of the course is - 1. To make student understand IoT 2. To understand the working of Micro-Controller & Micro-Computer 3. To explain various types of sensors 4. To introduce students with Programming in IoT
Pre-requisite	C , C++, PHP
Course Outcome	After studying this, student will be able to understand how Micro-Controller & Micro-Computer works. This course will also help students to appreciate the role of embedded systems in IoT environment. After successful completion, students will be able to work with different types of Micro-Controllers, Micro-Computers and sensors for their IoT based application development.
Course Content	**Unit 1: Internet of Things (IoT)** 1.1 Introduction to IoT 1.1.1 IoT Today 1.1.2 IoT Vision 1.2 IoT Architecture 1.2.1 Elements of IOT Ecosystem 1.3 IoT Related Standards and Protocols 1.4 Industrial Applications of IoT 1.5 IoT Privacy, Security & Governance 1.5.1 Identification in Distributed Environment 1.5.2 Device Authentication 1.5.3 Data Correlation and Information Retrieval 1.6 IOT Botnet **Unit 2: Sensors** 2.1 Introduction to Sensors 2.2 Types of Sensors & their work 2.3 Wireless Sensor Network **Unit 3: Micro-Controller: Arduino, NodeMCU** 3.1 What is a Micro-Controller? 3.2 Architecture of Microcontroller: 8051 3.3 Role of Microcontrollers in IoT 3.4 Introduction to Arduino 3.5 Working with Arduino IDE 3.6 NodeMCU 3.6.1 Features and Wireless capability 3.6.2 Difference between Arduino and NodeMCU 3.7 Interacting with Sensors & Micro-Controller **Unit 4: Micro-Computer: Raspberry Pi** 4.1 What is a Micro-Computer? 4.2 Difference between Micro-Controller and Micro-Computer

	4.3 Introduction to Pi family 4.4 Configuring Pi for IoT 4.5 Interacting with Sensors & Raspberry Pi **Unit 5: IoT Application Development** 5.1 Server side Development 5.2 Client side Development 5.3 Peer to Peer Interaction 5.4 IoT Interaction through Mobile Apps
Reference Books	1) Introduction to Embedded System – By Shibu K V , McGrawHill 2) Microcontrollers – Architecture, Programming, Interfacing and system design – By Raj Kamal , Pearson 3) Exploring C for Microcontrollers : A hands on approach, Springer 4) 8051 Microcontrollers an Application based Introduction, Elsevier 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) Raspberry Pi User Guide – By Eben Upton and Garath Halfacree, Wiley 9) Raspberry Pi for Dummies , Wiley 10) Microprocessor Architecture, Programming and Applications with the 8085 - By Ramesh Gaonkar , Penram International Publishing 11) Raspberry Pi IoT in C – By Harry Fairhead, I/O Press 12) Arduino for Dummies, Wiley 13) Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media 14) ESP8266: Get Started With ESP8266 Programming NodeMCU Using Arduino IDE, Createspace Independent Pub 15) Internet of Things Projects with ESP32, Packt Publishing Limited
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 502: **Artificial Intelligence and Knowledge Based Systems**

Course Code	502
Course Title	**Artificial Intelligence and Knowledge Based Systems**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of implementing the concepts, methods and tools of Artificial Intelligence and learn their implementation in Knowledge Based Systems
Course Objective	To acquaint students with concepts of Artificial Intelligence and its applications.
Pre-requisite	Data Structures, Information Systems
Course Outcome	After completion of this course, the students will be capable to use various Artificial Intelligence techniques in various applications.
Course Content	**Unit 1: Introduction to Artificial Intelligence** 1.1. What is AI 1.2. Applications of AI 1.3. Introduction to Expert System 1.4. Applications of expert systems **Unit 2: Knowledge Overview** 2.1. Definition and importance of knowledge 2.2. Overview knowledge representation 2.3. Overview of knowledge organization 2.4. Overview of knowledge Manipulation 2.5. Overview of Knowledge Acquisition **Unit 3: Representation and Search** 3.1. Structured Knowledge 3.1.1. Associative networks 3.1.2. Frame structures 3.1.3. Conceptual dependencies and scripts 3.2. Object oriented representation **Unit 4: Organization and Manipulation, Knowledge Acquisition** 4.1. Introduction to organization 4.2. Search techniques 4.2.1. Uninformed search 4.2.2. Informed search 4.2.3. Introduction to matching Techniques 4.3 Knowledge Acquisition 4.3.1. Knowledge learning types 4.3.2. General learning models 4.3.3. Performance of learning models **Unit 5: Expert System** 5.1. Advantages of Expert Systems 5.2. Characteristics of Expert Systems 5.3. Design of Expert Systems 5.3.1. Selecting Problem 5.3.2. Stages in Expert systems development 5.3.3. Errors in developments

	5.3.4. Expert System Software Engineering 5.3.5. Expert System Life Cycle
Reference Books	1. Introduction to Artificial Intelligence and Expert System by Dan W. Patterson, PHI (1999) 2. Artificial Intelligence – A Modern Approach (2nd Edition 2004) by Stuart J. Russell and Peter Norvig, Pearson Education 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) 5. Expert Systems Principles and Programming (3rd Edition) by Giarratano & Riley, Thomson (Vikas Pulishing House) 6. Introduction to Artificial Intelligence by Rajendra Akerkar, PHI
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 503: **ERP Using SAP**

Course Code	503
Course Title	**ERP Using SAP**
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	This course imparts fundamental as well as detailed Enterprise Resource Planning using SAP technology platform.
Course Objective	Learn ERP applications and its programming
Pre-requisite	Fundamentals of ERP, DBMS
Course Outcome	After studying this students will be able to understand how to work with ERP modules. After successful completion, students will be able to develop ERP application using SAP.
Course Content	**Unit 1: Introduction** 1.1 Introduction to ERP 1.2 Introduction to SAP 1.3 Example: How SAP works in an Organization **Unit 2: Architecture of SAP Application Server** 2.1 3-Tier Architecture 2.2 Application Servers 2.3 Work processes and its Type **Unit 3: Data Dictionary & Data Structures in ABAP** 3.1 Introduction to Data dictionary 3.2 Different Types of Data structures 3.3 Internal Tables and its operation **Unit 4: Modularization Techniques** 4.1 Include Programs 4.2 Subroutines 4.3 Function Module. 4.4 Types of Function Module(Simple, RFC enabled, BAPI) **Unit 5: List Report, ALV Report** 5.1 Simple List Report 5.2 Interactive List Report 5.3 Events in List Reports 5.4 Field catalog generation in ALV 5.5 Operation on ALV(Sorting, Filtering, Totals, Subtotals, Download, Hide Columns) **Unit 6: Module pool programming / Screen Programming** 6.1 Screen Elements(Simple & Complex) 6.2 Screen Events(PBO/PAI) 6.3 Transactions **Unit 7: Selection-Screen programming** 7.1 Defining Selection Screen. 7.2 User Actions on Selection Screen. 7.3 Events of Selection Screen

	Unit 8: Smartform/Sapscript 8.1 Form printing with smartform 8.2 Form printing with Sapscript **Unit 9: BDC & LSMW** 9.1 Data upload through BDC 9.2 Data upload through LSMW **Unit 10: Enhancement(Exits & BADI)** 10.1 What is Enhancement 10.2 User-Exits 10.3 BADI(Business Add-in)
Reference Books	1. ABAP Cookbook by James Wood 2. BC - ABAP Programming from SAP-AG 3. Teach Yourself ABAP/4 in 21 Days by Ken Greenwood, SAMS 4. SAP Smart Forms by Christoph Wachter, Werner Hertleif 5. SAPscript by Michaelson Buchanan 6. Developing Sap's R/3 Application with Abap/4 7. Data Migration Made Easy - R/3 Simplications Group, SAP Labs 8. ABAP Development for SAP NetWeaver BW: Exits, BAdIs, and Enhancements by Dirk Herzog 9. Next Generation ABAP Development (2nd Edition) by Rich Heilman and Thomas Jung
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 semester end University External examination

Course: 503: **NoSQL Databases**

Course Code	503
Course Title	**NoSQL Databases**
Credit	4
Teaching per Week	4
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2020
Purpose of Course	To teach the emerging trends in NoSQL databases
Course Objective	To impart knowledge of NoSQL Databases
Pre-requisite	Fundamentals of DBMS
Course Outcome	Students will be able to learn NoSQL databases – namely MongoDB and Cassandra
Course Content	**Unit 1: Introduction** 1.1 History 1.2 Concepts and Characteristics of NoSQL databases 1.3 Primary benefits of NoSQL databases **Unit 2: MongoDB** 2.1 SQL/NoSQL landscape 2.2 Document Vs. Other types of Storage 2.3 MongoDB feature set 2.4 Introduction to BSON and JSON 2.5 MongoDB Architecture 2.6 Documents and Collections 2.6.1 Creating Documents 2.6.2 Managing Documents in collections 2.6.3 Iterating over Documents 2.7 Queries 2.7.1 Simple Queries 2.7.2 Complex Queries 2.7.2.1 Existential field values 2.7.2.2 Aggregations and groups 2.7.2.3 Aggregations and groups in hierarchical data 2.8 Updates and Deletes 2.9 Updates and Arrays 2.10 Indexing 2.11 MongoDB RESTful API 2.12 MongoDB Security 2.13 MongoDB Replication and Sharing 2.14 Introduction to MapReduce **Unit 3: Cassandra** 3.1 Cassandra Architecture 3.1.1 Cassandra P2P Architecture 3.1.2 Clustering Structures- Nodes 3.1.3 Rings 3.1.4 Virtual Nodes 3.1.5 Consistency & Hashing 3.1.6 Gossip Protocol 3.1.7 Data Replication 3.1.8 Replication Factors & Indexes 3.1.9 Tunable Consistency 3.1.10 High & Rapid Scalability Memtables, SStables & Commitlogs

	3.1.11 Repairs 3.1.12 Tombstones 3.1.13 Repairs 3.1.14 Replication Factors 3.1.15 Compaction and Anti-Entropy 3.1.16 Bloom Filters 3.2 Data Modelling in Cassandra 3.3 Cassandra Administration 3.4 CQL3 3.5 Integration with Hadoop
Reference Books	1. Chodorow, K. (2013). MongoDB: The Definitive Guide (2nd ed.). Upper Saddle River, NJ: Pearson Education, Inc. ISBN-13: 978-1449344689 ISBN-10: 1449344682. 2. Shashank Tiwari, Professional NoSQL, Sierra Nevada Books, ISBN-13: 978-0470942246 3. Amol Nayak, Instant MongoDB, Packt Publishing Limited, 2013, ISBN-13: 978-1782169703 4. Kristina Chodorow, MongoDB Definitive Guide 2e, O'Reilly, 2013, ISBN-13: 978-1449344689 5. Eben Hewitt, Cassandra Definitive Guide, O'Reilly, 2010, ISBN:ISBN 10:1-4493-9041-2
Teaching Methodology	Classroom, seminar 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 semester end University External examination

Course: 504: **Advanced Database Administration**

Course Code	504
Course Title	**Advanced Database Administration**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	Understanding advanced database administration
Course Objective	To learn advanced database administration, database tuning and maintenance
Pre-requisite	RDBMS
Course Out come	After studying the course, students will be able to perform Database Administration
Course Content	**Unit 1. Oracle10g Instance creation and management** 1.1 Oracle Instance 1.2 Installing Oracle 1.3 Oracle Optimal Flexible Architecture (OFA) 1.4 Locating initialization, listener.ora & sqlnet.ora files 1.5 Finding the alert log 1.6 Common environment variables 1.7 Structures in an Oracle Instance 1.8 Oracle Memory Structures, SGA and PGA 1.9 Oracle Processes and their purposes 1.10 Startup, nomount, mount and open database commands **Unit 2. Oracle10g Database Architecture** 2.1 Oraclde10g management framework 2.1 Using the Database Creation Assistant (DBA) 2.3 Creating and dropping a database 2.4 Tablespaces 2.5 Tables and Indexes 2.6 Clusters 2.7 Partitioning of Tables and Indexes 2.8 Gathering and applying patches **Unit 3. Concurrency Management** 3.1 Transactions, serialization, locks and latches 3.2 Lock modes 3.3 Detecting and resolving lock conflicts 3.4 Managing deadlocks **Unit 4. Interfacing with Oracle** 4.1 Oracle transaction management 4.2 Using SQL*Plus and iSQL*Plus 4.3 Using embedded Oracle with Pro*C & Java 4.4 PL/SQL & Triggers 4.5 Pining PL/SQL packages & compiling PL/SQL 4.6 System-level triggers – startup trigger, logon trigger, PL/SQL error trigger **Unit 5. Oracle*Net** 5.1 Basic Network structure 5.2 Oracle*Net Files 5.3 Multi-threaded server 5.4 Create additional listeners 5.5 Create Oracle Net service aliases

5.6 Configure connect time failover
5.7 Oracle*Net names resolution

Unit 6. Tablespace Management Overview
6.1 Dictionary Managed Tablespaces
6.2 Locally Managed Tablespaces
6.3 Automatic Segment Space Management
6.4 Moving tablespaces online and offline

Unit 7. UNDO Tablespace Management
7.1 Use of undo segments
7.2 Creating an undo tablespace
7.3 User managed undo tablespaces
7.4 Automatic undo management
7.5 Monitor & Configure undo retention
7.6 Use the Undo Advisor
7.7 Size the undo tablespace

Unit 8. Oracle Utilities
8.1 Datapump - Import/export
8.2 SQL*Loader
8.3 Oracle Streams
8.4 Automatic Database Diagnostic Monitor
8.5 Automatic Tuning Optimizer
8.6 Automatic Shared Memory Tuning

Unit 9. Oracle Performance Tuning
9.1 Locate invalid and unusable objects
9.2 Gather SQL optimizer statistics with dbms_stats
9.3 Basic Oracle performance metrics
9.4 Use OEM and dbms_alert to set warning and critical alert thresholds
9.5 The SQL Tuning Advisor
9.6 The SQL Access Advisor
9.6 Interpreting server generated alerts
9.7 Oracle advisory utilities vdb_cache_advice, vshared pool_advice, v$pga_aggregate_target_advice
9.8 Using OEM performance screens
9.9 Fixing performance issues

Unit 10. User Management
10.1 Creating Users
10.2 Altering users
10.3 User Profiles
10.4 User resource groups
10.5 Granting privileges & roles
10.6 Auditing user activity with dbms_audit

Unit 11. Oracle Security
11.1 Password use in Oracle, Password encryption and password aging, External authentication, Using Single sign-on (SSO)
11.2 Object security
11.3 Virtual Private Databases (VPD) in Oracle
11.4 Oracle “grant execute” security
11.5 Use of Roles in Oracle
11.6 Register for security updates

Unit 12. Backup & Recovery

	12.1 Oracle backup & recovery planning 12.2 Parallel instance recovery 12.3 Basics of checkpoints, redo log files, and archived log files 12.4 Using ARCHIVELOG mode 12.5 Creating consistent Oracle backups 12.6 Online hot backups 12.7 Incremental Oracle backups 12.8 Automating database backups with dbms_scheduler 12.9 Monitor the flash recovery area 12.10 Recovering from loss of a Control file 12.11 Recovering from loss of a Redo log file 12.12 Recovering from loss of a system-critical data file 12.13 Recovering from loss of a non system-critical data file
Reference Books	1. Essentials : Oracle Database 10g by Rick Greenwald, Robert Stackowiak, Jonathan Stern, O'Reilly 2. Oracle High Performance Tuning for 9i and 10g by Gavin Powell, Digital Press 3. Oracle Database 10g, DBA Handbook by Loney, Kevin, Bryla, Bob, Oracle Press 4. Oracle Database 10g - The Complete Reference by Loney, Kevin, Oracle Press 5. Oracle Database 10g: A Beginner's Guide by Micheal Abbey, Ian Abramson Osborne, Oracle Press Series
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 505: **Data Warehousing & Data Mining**

Course Code	505
Course Title	**Data Warehousing & Data Mining**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	Understanding Data Warehousing and Data Mining
Course Objective	To understand data warehousing and data mining - concepts and methods, and apply them in practice
Pre-requisite	RDBMS, Basics of statistics
Course Outcome	After studying the course, students will learn data warehousing and data mining and its effective use in various applications
Course Content	**Unit 1: Data warehouse: Introduction** 1.1 Data Warehouse characteristics 1.2 Data Marts 1.3 OLTP and OLAP systems 1.4 Star, Snowflakes, and Fact Constellations Schemas for Multi-dimensional Databases 1.5 OLAP Operations in the Multidimensional data model 1.6 Type of OLAP servers **Unit 2: Developing Data Warehouse** 2.1 Building a Data Warehouse 2.2 Three-Tier Data Warehouse Architecture 2.3 Metadata Repository **Unit 3: Data Pre-processing** 3.1 Descriptive Data Summarization: central tendency, disperation of data 3.2 Data Cleaning : missing values, noisy data 3.3 Data Integration & Transformation 3.4 Data Reduction: Attribute selection 3.5 Data Discretization & Concept Hierarchy Generation **Unit 4: Data Mining: Introduction** 4.1 Knowledge discovery and Data Mining. 4.2 Basic Introduction to Data Mining Functionalities: 4.2.1 Concept/Class Description Characterization & Discrimination 4.2.2 Mining Frequent Patterns, Associations, and Correlations 4.2.3 Classification & Prediction 4.3.4 Cluster Analysis 4.2.5 Outlier Analysis 4.2.6 Evolution analysis **Unit 5: Mining Frequent Patterns, Associations, and Correlations** 5.1 Basic concepts: Frequent Itemsets & Closed Itemsets, Association Rules 5.2 The Apriory algorithm: Finding Frequent Itemsets Using Candidate Generation 5.3 FP-growth: Finding Frequent Itemsets without Candidate Generation 5.4 Generating Association Rules from Frequent Itemsets 5.5 Introduction to multilevel and multidimensional Association rules **Unit 6: Classification & Prediction**

	6.1 Introduction to Classification & Prediction? 6.2 Prediction: Linear Regression, Nonlinear Regression 6.3 Decision Tree Algorithm 6.3.1 Decision Tree Induction 6.3.2 Attribute Selection Measures- Information Gain and Gain Ratio 6.3.3 Tree Pruning 6.4 Bayesian Classification 6.4.1 Bayes' Theorem 6.4.2 Naïve Bayesian Classification 6.5 Accuracy and Error Measures for classification **Unit 7: Cluster Analysis** 7.1 Classification vs. clustering 7.2 What is Partitioning & Hierarchical Clustering Methods 7.3 Classical Partitioning Methods: k-Means **Unit 8: Application and Trends in Data Mining**
Reference Books	1. Data Mining: Concepts & Techniques by Han & Kamber , Morgan Kaufmann Publishers 2. Introduction to Data Mining with Case Studies by G. K. Gupta, PHI 3. Data Mining Introductory and Advanced Topics by Dunha, Pearson 4. Data Warehouse Toolkit by R. Kinball, John Wiley & Sons 5. Data Warehouses and OLAP: Concepts, Architectures, and Solutions by Robert Wrembel, Christian Koncilia I, GI 6. Data Mining Techniques: For Marketing, Sales, and Customer Relationship Management by Gordon S. Linoff, Michael J. A. Berry, Wiley 7. Data Preparation for Data Mining by Dorian Pyle, Morgan Kaufmann Publishers 8. Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals by Paulraj Ponniah, Wiley 9. Data Warehousing: Concepts, Techniques, Products and Applications by C.S.R. Prabhu, PHI Learning 10. Advanced Data Mining Techniques by David Louis Olson, Dursun Delen, Springer
Teaching Methodology	Class work, Discussion, Self-study, Seminars and/or 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 semester end University External examination

Course: 505: **Big Data**

Course Code	505
Course Title	**Big Data**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	Understanding distributed computing, Big Data and Hadoop
Course Objective	To learn Big Bata and Hadoop
Pre-requisite	RDBMS
Course Out come	After studying the course, students will have understanding distributed computing and will have hands-on experience on Hadoop
Course Content	**Unit 1: Introduction** 1.1 Evolution of Big Data 1.2 Structuring Big Data 1.3 Elements of Big Data(V's) 1.4 Big Data Analytics 1.5 Commercial use of Big Data **Unit 2: Big Data Technology** 2.1 Distributed and Parallel Computing 2.2 Introducing Hadoop 2.3 HDFS and MapReduce 2.4 Cloud Computing and Big Data 2.5 In-Memory Computing **Unit 3: Hadoop** 3.1 HDFS Architecture 3.2 Blocks 3.3 Name Nodes and Data Nodes 3.4 Using HDFS Files 3.5 Hadoop Specific File System Types 3.6 HDFS Commands 3.7 org.apache.hadoop.io package 3.8 MapReduce Architecture 3.9 Hadoop YARN 3.10 HBase 3.11 Combining HBase 3.12 Hive 3.13 Pig and Pig Latin 3.14 Sqoop **Unit 4: Technology Foundations** 4.1 Big Data Stack 4.2 Virtualization and Big Data **Unit 5: Storing Data in Databases and Processing of Data** 5.1 RDBMS and Big Data 5.1.1 CAP Theorem 5.3 NoSQL Databases 5.4 Polygot Persistence 5.5 Integrating Big Data with traditional Data Warehouses 5.6 Big Data Analytics

	5.7 Processing Data with MapReduce 5.8 Customizing MapReduce Execution and implementing MapReduce Program 5.9 Testing and Debugging MapReduce Applications 5.10 Analytical Approaches and Tools to Analyze Data
Reference Books	1. D T Editorial services, Big Data Black book, Dreamtech Press, ISBN 978-93-5119-931 2. Alex Holmes, Hadoop in Practice, Manning Publication company, 2014, ISBN 1617292222, 9781617292224 3. Kuan-Ching, Li Hai Jiang, Laurence T. Yang Alfredo Cuzzocrea, Big Data : Algorithms, Analytics and Applications. CRC Press 4. Hu, Wen Chen, Big Data Management, Technologies and Applications, IGI Global 5. Tom White, Hadoop The Definitive Guide, o'Reilly
Teaching Methodology	Class work, Discussion, Self Study, Seminars and/or 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 semester end University External examination

Course: 506: **Programming Skills XI**

Course Code	506
Course Title	**Programming Skills XI**
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement the Unix Internals with shell programming/IOT practically.
Course Objective	Learning to implement fundamentals and advanced topics of Unix Internals with Shell Scripting/IOT practically
Pre-requisite	Practical programming in desktop environment / Embedded Technology
Course Outcome	After studying the course, students will be able to practically work on advanced technology platforms of Unix Internals with Shell Scripting /IOT.
Course Content	Practical based on paper no 501. Separate journal to be prepared for this subject based on 501.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 507: **Programming Skills XII**

Course Code	507
Course Title	**Programming Skills XII**
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement the concepts of SAP/NoSQL practically
Course Objective	Learning to implement the ERP using SAP/NoSQL databases practically
Pre-requisite	DBMS
Course Outcome	After studying the course, students will be able to practically work on SAP/NoSQL Databases
Course Content	Practical based on paper no 503. Separate journal to be prepared for this subject 503.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 508: **Programming Skills XIII**

Course Code	508
Course Title	**Programming Skills XIII**
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to handle advanced database administration activities
Course Objective	Advanced database administration
Pre-requisite	Practically learning advanced database administration
Course Outcome	After studying the course, students will be able to handle database administration, tuning and maintenance in various fields
Course Content	Practical based on paper no 504. Separate journal to be prepared for this subject 504.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 509: **Programming Skills XIV**

Course Code	509
Course Title	**Programming Skills XIV**
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement Data warehousing & data mining / Big Data practically.
Course Objective	Learn to use Data warehousing and data mining techniques in various practical environments / use Big data practically.
Pre-requisite	Databases, SQL, Advanced SQL
Course Outcome	After studying the course, students will be able to understand Data warehousing and data mining/Big Data practically
Course Content	Practical based on paper no 505. Separate journal to be prepared for this subject 505.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

MCA 5th Sem. (Network Group)

Course: 501: **Unix Internals & Shell Programming**

Course Code	501
Course Title	**Unix Internals & Shell Programming**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of implementing the concepts, methods and tools of Unix internals & Shell Programming
Course Objective	The objective of the course is - 1. Acquaint the student with the Unix Operating System 2. shell programming and Internals of the Unix O.S.
Pre-requisite	Operating Systems, Programming Skills
Course Out come	After completion of this course, the student will be capable to develop, manage and maintain Unix & shell based programming. The student will be capable of working with Unix OS.
Course Content	**Unit -1 Introduction & Overview of Unix OS** 1.1 Features of UNIX 1.2 System Structures 1.3 Shell and Its Features 1.4 Kernel 1.4.1 Architecture of the UNIX OS 1.4.2 Kernel Data Structures 1.5 Logging in & out 1.6 Inode & File Structure 1.7 File System Structure & Features 1.8 Booting Sequence & Init process 1.9 File Access Permission **Unit-2 Shell programming & Advanced Shell programming** 2.1 Basic Shell Programming 2.1.1 Environment & User defined Variables 2.1.2 Argument processing 2.1.3 Shell's Interpretation at prompt 2.1.4 Arithmetic Expression Evaluation 2.1.5 Control Structures 2.1.6 Redirection 2.1.7 Background Process & Priorities of Process 2.1.8 Conditional Execution 2.1.9 Parameter & quote substitution 2.1.10 Command Evaluation & Command Grouping 2.1.11 Trapping Signals 2.2 Advanced Shell Programming & Utilities 2.2.1 Filtering Utilities – sed 2.2.2 awk 2.2.3 Batch Processes 2.2.4 Splitting, Comparing, Sorting, Merging and Ordering Files 2.2.5 Terminals Handling 2.2.6 Communication with Other Users 2.2.7 Spooling and Print Management 2.2.8 Backup and Recovery 2.2.9 Remote Login, File Transfer & sharing

	Unit-3 File System & Internal Representation 3.1 Structure of Buffer Pool 3.2 Superblock 3.3 Inode assignment to file 3.4 Reading, writing and allocation of disk blocks 3.5 System calls for File System **Unit-4 Process Management** 4.1 Status and Transitions 4.2 Context and manipulation of process address space 4.3 Process creation and termination 4.4 Process scheduling 4.5 System calls for process management 4.6 Inter Process Communication **Unit-5 Memory Management & I/O Subsystem** 5.1 Swapping 5.2 Demand Paging 5.3 System Calls for memory management 5.4 Solution with semaphore 5.5 The I/O Subsystem 5.5.1 Driver interface 5.5.2 Disk and terminal drivers 5.5.3 Streams **Self Study :** Sockets programming.
Reference Books	1. The Design of UNIX OS, M.J. Bach, Prentice Hall 2. UNIX for Super-Users, Eric Foxley, Addision Wesley 3. The UNIX Programming Environment by Brian W. Kernighan, Pike Prentice Hall of India 4. UNIX Network Programming , The Socket Networking API Vol. 1 by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff Prentice Hall of India 5. UNIX Network Programming, Interpocess Communication 6. Networking API Vol.2. by W. Richard Stevens PHI 7. C and UNIX Programming by N. Kutti Tata McGraw Hill 8. UNIX Shells – Bourne, Korn & C Vijay Mukhi BPB Publication
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30 % internal assessment and 70% external assessment

Course: 501: **Internet of Things (IoT)**

Course Code	501
Course Title	**Internet of Things (IoT)**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course is an introduction for students to IoT. The course also gives students an idea about various components of IoT and explain its working. The course also explains the role of embedded systems in IoT ecosystem.
Course Objective	The objective of the course is - 1. To make student understand IoT 2. To understand the working of Micro-Controller & Micro-Computer 3. To explain various types of sensors 4. To introduce students with Programming in IoT
Pre-requisite	C , C++, PHP
Course Outcome	After studying this, student will be able to understand how Micro-Controller & Micro-Computer works. This course will also help students to appreciate the role of embedded systems in IoT environment. After successful completion, students will be able to work with different types of Micro-Controllers, Micro-Computers and sensors for their IoT based application development.
Course Content	**Unit 1: Internet of Things (IoT)** 1.1 Introduction to IoT 1.1.1 IoT Today 1.1.2 IoT Vision 1.2 IoT Architecture 1.2.1 Elements of IOT Ecosystem 1.3 IoT Related Standards and Protocols 1.4 Industrial Applications of IoT 1.5 IoT Privacy, Security & Governance 1.5.1 Identification in Distributed Environment 1.5.2 Device Authentication 1.5.3 Data Correlation and Information Retrieval 1.6 IOT Botnet **Unit 2: Sensors** 2.1 Introduction to Sensors 2.2 Types of Sensors & their work 2.3 Wireless Sensor Network **Unit 3: Micro-Controller: Arduino, NodeMCU** 3.1 What is a Micro-Controller? 3.2 Architecture of Microcontroller: 8051 3.3 Role of Microcontrollers in IoT 3.4 Introduction to Arduino 3.5 Working with Arduino IDE 3.6 NodeMCU 3.6.1 Features and Wireless capability 3.6.2 Difference between Arduino and NodeMCU 3.7 Interacting with Sensors & Micro-Controller **Unit 4: Micro-Computer: Raspberry Pi** 4.1 What is a Micro-Computer? 4.2 Difference between Micro-Controller and Micro-Computer

	4.3 Introduction to Pi family 4.4 Configuring Pi for IoT 4.5 Interacting with Sensors & Raspberry Pi **Unit 5: IoT Application Development** 5.1 Server side Development 5.2 Client side Development 5.3 Peer to Peer Interaction 5.4 IoT Interaction through Mobile Apps
Reference Books	1) Introduction to Embedded System – By Shibu K V , McGrawHill 2) Microcontrollers – Architecture, Programming, Interfacing and system design – By Raj Kamal , Pearson 3) Exploring C for Microcontrollers : A hands on approach, Springer 4) 8051 Microcontrollers an Application based Introduction, Elsevier 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) Raspberry Pi User Guide – By Eben Upton and Garath Halfacree, Wiley 9) Raspberry Pi for Dummies , Wiley 10) Microprocessor Architecture, Programming and Applications with the 8085 - By Ramesh Gaonkar , Penram International Publishing 11) Raspberry Pi IoT in C – By Harry Fairhead, I/O Press 12) Arduino for Dummies, Wiley 13) Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media 14) ESP8266: Get Started With ESP8266 Programming NodeMCU Using Arduino IDE, Createspace Independent Pub 15) Internet of Things Projects with ESP32, Packt Publishing Limited
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 502: **Artificial Intelligence and Knowledge Based Systems**

Course Code	502
Course Title	**Artificial Intelligence and Knowledge Based Systems**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of implementing the concepts, methods and tools of Artificial Intelligence and learn their implementation in Knowledge Based Systems
Course Objective	To acquaint students with concepts of Artificial Intelligence and its applications.
Pre-requisite	Data Structures, Information Systems
Course Outcome	After completion of this course, the students will be capable to use various Artificial Intelligence techniques in various applications.
Course Content	**Unit 1: Introduction to Artificial Intelligence** 1.1. What is AI 1.2. Applications of AI 1.3. Introduction to Expert System 1.4. Applications of expert systems **Unit 2: Knowledge Overview** 2.1. Definition and importance of knowledge 2.2. Overview knowledge representation 2.3. Overview of knowledge organization 2.4. Overview of knowledge Manipulation 2.5. Overview of Knowledge Acquisition **Unit 3: Representation and Search** 3.1. Structured Knowledge 3.1.1. Associative networks 3.1.2. Frame structures 3.1.3. Conceptual dependencies and scripts 3.2. Object oriented representation **Unit 4: Organization and Manipulation, Knowledge Acquisition** 4.1. Introduction to organization 4.2. Search techniques 4.2.1. Uninformed search 4.2.2. Informed search 4.2.3. Introduction to matching Techniques 4.3 Knowledge Acquisition 4.3.1. Knowledge learning types 4.3.2. General learning models 4.3.3. Performance of learning models **Unit 5: Expert System** 5.1. Advantages of Expert Systems 5.2. Characteristics of Expert Systems 5.3. Design of Expert Systems 5.3.1. Selecting Problem 5.3.2. Stages in Expert systems development 5.3.3. Errors in developments

	5.3.4. Expert System Software Engineering 5.3.5. Expert System Life Cycle
Reference Books	1. Introduction to Artificial Intelligence and Expert System by Dan W. Patterson, PHI (1999) 2. Artificial Intelligence – A Modern Approach (2nd Edition 2004) by Stuart J. Russell and Peter Norvig, Pearson Education 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) 5. Expert Systems Principles and Programming (3rd Edition) by Giarratano & Riley, Thomson (Vikas Pulishing House) 6. Introduction to Artificial Intelligence by Rajendra Akerkar, PHI
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 503: **Network Essentials and its Security**

Course Code	503
Course Title	**Network Essentials and its Security**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	To make students learn Network essentials and various security measures for the challenges to which the IT industry is exposed
Course Objective	To understand Network Management and its security
Pre-requisite	Computer Network, TCP/IP
Course Outcome	Students will be able to solve and determine best solutions for the challenging area of Network Security
Course Content	**Unit 1: Network Essentials** 1.1 Repeaters & Bridges 1.1.1 LAN Expansion 1.1.2 Repeaters 1.1.3 Bridges 1.1.4 How Bridges Work 1.1.5 Creating the routing table 1.1.6 Segmenting Network Traffic 1.1.7 Remote Bridges 1.1.8 Differentiating between bridges and repeaters 1.2 Routers & Gateways 1.2.1 Routers 1.2.2 How routers work 1.2.3 Routing benefits 1.2.4 Routing protocols 1.2.5 Routing V/S Bridging 1.2.6 B Routers 1.2.7 Gateways 1.2.8 How Gateways work 1.3 Network Administration 1.3.1 Bottlenecks 1.3.2 Simple Network Management Protocol 1.3.3 Data Protection 1.3.4 Backup Methods 1.3.5 Testing and Storage 1.3.6 Implementing a Backup System 1.3.7 Uninterruptible Power Suppliers 1.3.8 How Gateways work 1.3.9 Implementing Fault Tolerant Systems 1.3.10 RAID 1.3.11 Sector Sparing 1.4 Advance WAN Transmission 1.4.1 Overview 1.4.2 Multiplexing, Packet and Circuit Switching Networks 1.4.3 X.25 1.4.4 Asynchronous Transfer Mode (ATM) 1.4.5 ISDN 1.4.6 SONET 1.4.7 SMDS **Unit 2: Introduction to Network Security** **Unit 3: Cryptography Techniques** 3.1 Classical Cryptography

	3.2 Conventional Cryptography 3.2.1 DES 3.3 Public – key Cryptography 3.3.1 RSA 3.4 Digital Signatures 3.4.1 DSA **Unit 4: Security Services** 4.1 Message Integrity 4.2 Confidentiality and Authentication 4.3 Certification and Key Management 4.3.1 PKI **Unit 5: Network Security Applications** 5.1 IP Security 5.1.1 IPsec 5.2 Web Security 5.2.1 SSL, TLS, SET 5.3 Electronic Mail Security 5.3.1 PGP, S/MIME 5.4 SNMP Security **Unit 6: Access Control in Computer Networks** 6.1 Authentication Protocols and Services 6.1.1 Kerberos and X.509 6.2 Firewalls 6.3 Virtual Private Networks (VPNs) **Unit 7: System Security** 7.1 Intrusion detection 7.2 Viruses **Unit 8: Mobile System & E-Commerce Securities** 8.1 3G Security 8.2 E-Payment Systems 8.3 Fair Data Exchange
Reference Books	1) Cryptography and Network Security, 2/e, ISBN: 0-13-869017-0 - W. Stallings - Pearson Education, 1999 2) Network Security Essentials: Applications and Standards, 1/e, ISBN: 0-13-016093-8 - W. Stallings - Pearson Education, 2000 3) SSL and TLS: designing and building secure systems, ISBN: 0-201-61598-3 - E. Rescorla - Addison-Wesley, 2001 4) Implementing Secure Intranets and Extranets, ISBN: 0-89006-447-4 - K M Phaltankar - Artech House Publishers, 2000 5) Secure Electronic Commerce: Building the Infrastructure for Digital Signature and Encryption, ISBN: 0-13-027276-0 - W. Ford, and M. Baum - Prentice Hall, 2001 6) Security in Computing, ISBN: 0-13-185794-0, 2/e - C. P. Pfleeger - Prentice Hall, 1997 7) Building Internet Firewalls, 2/e, ISBN: 1-56592-871-7 - E. D. Zwicky, et al - O'Reilly, 2000 8) CDMA Cellular Mobile Communications & Network Security, ISBN: 0-13-598418-1 - M. Y. Rhee, - Prentice Hall, 1998 9) Journal of Computer Security 10) ACM Transactions on Information and System Security 11) ACM Conference on Computer and Communications Security 12) IEEE Symposium on Security and Privacy

	13) Internet documents - RFCs (Request for Comments) 14) Guide to Networking Essentials, Fourth Edition - Greg Tomsho, et al 15) Computer Networking Essentials - Debra Littlejohn Shinder 16) Networking Essentials: Hands-On, Self-Paced Training for Supporting Local and Wide Area Networks - Microsoft Corporation (Corporate Author) 17) Computer Network - A. S. Tanenbaum
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 504: **Network Administration**

Course Code	504
Course Title	**Network Administration**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	Understanding advanced network administration
Course Objective	To learn advanced network administration, its configuration and maintenance
Pre-requisite	Computer Network, TCP/IP
Course Outcome	After studying the course, students will be able to perform Network Administration
Course Content	**Unit 1: Networking and TCP/IP on Linux** a. Fundamentals of Linux Networking b. Fundamentals of TCP/IP on the Linux Operating System c. Advanced Linux TCP/IP Concepts d. Introduction to Dial-up Technologies **Unit 2: Dynamic Host Configuration Protocol** 2.1 Introduction to BOOTP and DHCP 2.2 Installing and Examining a Linux DHCP server 2.3 Examining Additional DHCP Options and Configurations **Unit 3: Domain Name System** 3.1 Introduction to the Domain Name System 3.2 Installing and Configuring DNS **Unit 4: The Network File System** 4.1 Introduction to the Network File System 4.2 Configuring NFS **Unit 5: Linux Remote Administration** 5.1 Introduction to Remote Administration 5.2 The Telnet Protocol 5.3 The open secure Shell protocol **Unit 6: The Cron Daemon** 6.1 Introduction to Automation 6.2 Configuring the Cron Daemon **Unit 7: Samba** 7.1 Introduction to Samba 7.2 Cross-Platform Connectivity 7.3 Installing and Configuring Samba **Unit 8: Linux System-Wide Logging** 8.1 Introduction to System-wide Logging 8.2 Configuring System-Logging **Unit 9: The Network Information Service** 9.1 Introduction to NIS 9.2 Setting Up and Configuring an NIS server
Reference Books	1) TCP/IP Network Administration - Craig Hunt - O'Reilly & Associates 2) Managing NFS and NIS - Hal Stern - O'Reilly & Associates

	3) DNS and BIND - Albitz/Liu - O'Reilly & Associates 4) Sendmail - Bryan Costales/Eric , Allman/Neil Rickert - O'Reilly & Associates 5) UNIX System Administration Handbook - Second Edition - Nemeth/Snyder/Seebass - Prentice Hall 6) Red Hat Linux Networking and System Administration – Terry Collings, Kurt Wall 7) Red Hat Linux 9 Bible - Christopher Negus 8) Official Red Hat Linux User's Guide - Red Hat Inc. 9) Official Red Hat Linux Administrator's Guide - Red Hat Inc. 10) Red Hat Linux Security and Optimization - Mohammad J. Kabir
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 505: **Wireless Network and Mobile Computing**

Course Code	505
Course Title	**Wireless Network and Mobile Computing**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	Understanding Wireless Network and Mobile Computing
Course Objective	To understand various aspects related to Wireless Network technologies, mobile networks and its computing
Pre-requisite	Computer Network
Course Outcome	Students will be able to implement various Wireless Network protocols and learn Mobile Computing
Course Content	**Unit 1: Introduction to Wireless Network Technologies** 1.1 Introduction 1.2 Standards 1.3 Emerging Technologies 1.4 OSI Basics 1.5 LAN Basics 1.6 LAN & WAN Protocols 1.7 Internet Protocol **Unit 2: Wireless LAN Technologies, Implementation and Layers** 2.1 Frequency Hopping Spread Spectrum 2.2 Direct Sequence Spread Spectrum (DSSS) 2.3 Interference 2.4 RF Math 2.5 Service Sets 2.6 Mobile IP 2.7 Appropriate use and design of wireless NetworkingMultipath 2.8 Co-location 2.9 Power-over-Ethernet (PoE) 2.10 Modulation and Bit Coding 2.11 Fragmentation 2.12 SIFS / PIFS / DIFS / EIFS **Unit 3: Hardware Configuration, Implementation and Protocols** 3.1 Access Points 3.2 Bridges 3.3 Workgroup bridges 3.4 Wireless Residential Gateways 3.5 Host Connectivity 3.6 Antennas, Cables, & Connectors 3.7 MAC and Routing Protocols for IEEE 802.11 3.8 Wireless Mesh Networks **Unit 4: MANET** 4.1. Various applications of MANET 4.2. Destination- Sequenced Distance Vector protocol 4.3. Dynamic Source Routing protocol 4.4. Ad Hoc On-Demand Distance-Vector protocol 4.5. Link Reversal Routing a. Gafni-Bertsekas algorithm b. Lightweight mobile routing algorithm.

	4.6. Temporally ordered routing algorithm **Unit 5: Introduction to Mobile Computing, GSM, GPRS & WAP** 5.1 Mobility, Nomadic, Mobile and Ubiquitous computing 5.2 Mobile Computing Architecture 5.3 Mobile Computing Technologies (Hardware, Software, Communication) 5.4 Introduction to GSM 5.5 GSM Architecture, Mobility Management, Network Signaling 5.6 GPRS Architecture 5.7 Network Nodes 5.8 Mobile Internet Standards, WAP Gateway and Protocols 5.9 WML
Reference Books	1) Wireless Local Area Network Fundamentals - Pejman Roshan, Jonathan Leary 2) Wireless Networks First Step (First-step series) - Jim Geier 3) 802.11 wireless network site surveying and installation - Bruce Alexander 4) Introduction to Wireless and Mobile Systems by Cengage Learning (Thompson) 5) J. Schiller, Mobile Communications, Addison –Wesley, 2003 6) Wi-Fi Security - Stewart Miller 7) Wireless and Mobile Network - Architecture Yi-Bing Lin & Imrich Chlamtac - John Wiley & Sons, 2001 8) Mobile and Wireless Design Essentials by Martyn Mallick, John Wiley & Sons 9) Guide to Designing and Implementing wireless LANs - Mark Ciampa - Thomson learning , Vikas Publishing House, 2001 10) Wireless Web Development - Ray Rischapter - Springer publishing, 2000
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 506: **Programming Skills XI**

Course Code	506
Course Title	**Programming Skills XI**
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement the Unix Internals with shell programming/IOT practically.
Course Objective	Learning to implement fundamentals and advanced topics of Unix Internals with Shell Scripting/IOT practically
Pre-requisite	Practical programming in desktop environment / Embedded Technology
Course Outcome	After studying the course, students will be able to practically work on advanced technology platforms of Unix Internals with Shell Scripting /IOT.
Course Content	Practical based on paper no 501. Separate journal to be prepared for this subject based on 501.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 507: **Programming Skills XII**

Course Code	507
Course Title	**Programming Skills XII**
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to understand the Networking and its security practically
Course Objective	Learning to implement Network and its security practically.
Pre-requisite	Network fundamentals
Course Outcome	After studying the course, students will be able to practically implement network and its security
Course Content	Practical based on paper no 503. Separate journal to be prepared for this subject 503.
Reference Books	-----
Teaching Methodology	Lab work, Practical Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 508: **Programming Skills XIII**

Course Code	508
Course Title	**Programming Skills XIII**
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to learn network administration
Course Objective	Students will learn administration of network practically
Pre-requisite	Networking fundamentals
Course Outcome	After studying the course, students will be able to practically perform administrative tasks of networks practically
Course Content	Practical based on paper no 504. Separate journal to be prepared for this subject 504.
Reference Books	-----
Teaching Methodology	Lab work, Practical Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 509: **Programming Skills XIV**

Course Code	509
Course Title	**Programming Skills XIV**
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement the basic and advanced concepts of wireless network and mobile computing
Course Objective	Learning wireless protocols and its implementation practically
Pre-requisite	Computer Network, C/C++ programming
Course Outcome	After studying the course, students will be able to practically develop/enhance wireless protocols and find better solutions application to the various industries dependent upon them
Course Content	Practical based on paper no 505. Separate journal to be prepared for this subject 505.
Reference Books	-----
Teaching Methodology	Lab work, Practical Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

MCA 5th Sem. (General Group)

Course: 501: **Unix Internals & Shell Programming**

Course Code	501
Course Title	**Unix Internals & Shell Programming**
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of implementing the concepts, methods and tools of Unix internals & Shell Programming
Course Objective	The objective of the course is - 1. Acquaint the student with the Unix Operating System 2. shell programming and Internals of the Unix O.S.
Pre-requisite	Operating Systems, Programming Skills
Course Out come	After completion of this course, the student will be capable to develop, manage and maintain Unix & shell based programming. The student will be capable of working with Unix OS.
Course Content	**Unit -1 Introduction & Overview of Unix OS** 1.1 Features of UNIX 1.2 System Structures 1.3 Shell and Its Features 1.4 Kernel 1.4.1 Architecture of the UNIX OS 1.4.2 Kernel Data Structures 1.5 Logging in & out 1.6 Inode & File Structure 1.7 File System Structure & Features 1.8 Booting Sequence & Init process 1.9 File Access Permission **Unit-2 Shell programming & Advanced Shell programming** 2.1 Basic Shell Programming 2.1.1 Environment & User defined Variables 2.1.2 Argument processing 2.1.3 Shell's Interpretation at prompt 2.1.4 Arithmetic Expression Evaluation 2.1.5 Control Structures 2.1.6 Redirection 2.1.7 Background Process & Priorities of Process 2.1.8 Conditional Execution 2.1.9 Parameter & quote substitution 2.1.10 Command Evaluation & Command Grouping 2.1.11 Trapping Signals 2.2 Advanced Shell Programming & Utilities 2.2.1 Filtering Utilities – sed 2.2.2 awk 2.2.3 Batch Processes 2.2.4 Splitting, Comparing, Sorting, Merging and Ordering Files 2.2.5 Terminals Handling 2.2.6 Communication with Other Users 2.2.7 Spooling and Print Management 2.2.8 Backup and Recovery 2.2.9 Remote Login, File Transfer & sharing

	Unit-3 File System & Internal Representation 3.1 Structure of Buffer Pool 3.2 Superblock 3.3 Inode assignment to file 3.4 Reading, writing and allocation of disk blocks 3.5 System calls for File System **Unit-4 Process Management** 4.1 Status and Transitions 4.2 Context and manipulation of process address space 4.3 Process creation and termination 4.4 Process scheduling 4.5 System calls for process management 4.6 Inter Process Communication **Unit-5 Memory Management & I/O Subsystem** 5.1 Swapping 5.2 Demand Paging 5.3 System Calls for memory management 5.4 Solution with semaphore 5.5 The I/O Subsystem 5.5.1 Driver interface 5.5.2 Disk and terminal drivers 5.5.3 Streams **Self Study :** Sockets programming.
Reference Books	1. The Design of UNIX OS, M.J. Bach, Prentice Hall 2. UNIX for Super-Users, Eric Foxley, Addision Wesley 3. The UNIX Programming Environment by Brian W. Kernighan, Pike Prentice Hall of India 4. UNIX Network Programming , The Socket Networking API Vol. 1 by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff Prentice Hall of India 5. UNIX Network Programming, Interpocess Communication 6. Networking API Vol.2. by W. Richard Stevens PHI 7. C and UNIX Programming by N. Kutti Tata McGraw Hill 8. UNIX Shells – Bourne, Korn & C Vijay Mukhi BPB Publication
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30 % internal assessment and 70% external assessment

Course: 501: **Internet of Things (IoT)**

Course Code	501
Course Title	**Internet of Things (IoT)**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course is an introduction for students to IoT. The course also gives students an idea about various components of IoT and explain its working. The course also explains the role of embedded systems in IoT ecosystem.
Course Objective	The objective of the course is - 1. To make student understand IoT 2. To understand the working of Micro-Controller & Micro-Computer 3. To explain various types of sensors 4. To introduce students with Programming in IoT
Pre-requisite	C , C++, PHP
Course Outcome	After studying this, student will be able to understand how Micro-Controller & Micro-Computer works. This course will also help students to appreciate the role of embedded systems in IoT environment. After successful completion, students will be able to work with different types of Micro-Controllers, Micro-Computers and sensors for their IoT based application development.
Course Content	**Unit 1: Internet of Things (IoT)** 1.1 Introduction to IoT 1.1.1 IoT Today 1.1.2 IoT Vision 1.2 IoT Architecture 1.2.1 Elements of IOT Ecosystem 1.3 IoT Related Standards and Protocols 1.4 Industrial Applications of IoT 1.5 IoT Privacy, Security & Governance 1.5.1 Identification in Distributed Environment 1.5.2 Device Authentication 1.5.3 Data Correlation and Information Retrieval 1.6 IOT Botnet **Unit 2: Sensors** 2.1 Introduction to Sensors 2.2 Types of Sensors & their work 2.3 Wireless Sensor Network **Unit 3: Micro-Controller: Arduino, NodeMCU** 3.1 What is a Micro-Controller? 3.2 Architecture of Microcontroller: 8051 3.3 Role of Microcontrollers in IoT 3.4 Introduction to Arduino 3.5 Working with Arduino IDE 3.6 NodeMCU 3.6.1 Features and Wireless capability 3.6.2 Difference between Arduino and NodeMCU 3.7 Interacting with Sensors & Micro-Controller **Unit 4: Micro-Computer: Raspberry Pi** 4.1 What is a Micro-Computer? 4.2 Difference between Micro-Controller and Micro-Computer

	4.3 Introduction to Pi family 4.4 Configuring Pi for IoT 4.5 Interacting with Sensors & Raspberry Pi **Unit 5: IoT Application Development** 5.1 Server side Development 5.2 Client side Development 5.3 Peer to Peer Interaction 5.4 IoT Interaction through Mobile Apps
Reference Books	1) Introduction to Embedded System – By Shibu K V , McGrawHill 2) Microcontrollers – Architecture, Programming, Interfacing and system design – By Raj Kamal , Pearson 3) Exploring C for Microcontrollers : A hands on approach, Springer 4) 8051 Microcontrollers an Application based Introduction, Elsevier 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) Raspberry Pi User Guide – By Eben Upton and Garath Halfacree, Wiley 9) Raspberry Pi for Dummies , Wiley 10) Microprocessor Architecture, Programming and Applications with the 8085 - By Ramesh Gaonkar , Penram International Publishing 11) Raspberry Pi IoT in C – By Harry Fairhead, I/O Press 12) Arduino for Dummies, Wiley 13) Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media 14) ESP8266: Get Started With ESP8266 Programming NodeMCU Using Arduino IDE, Createspace Independent Pub 15) Internet of Things Projects with ESP32, Packt Publishing Limited
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 502: **Artificial Intelligence and Knowledge Based Systems**

Course Code	502
Course Title	**Artificial Intelligence and Knowledge Based Systems**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	The purpose of the course is to make student capable of implementing the concepts, methods and tools of Artificial Intelligence and learn their implementation in Knowledge Based Systems
Course Objective	To acquaint students with concepts of Artificial Intelligence and its applications.
Pre-requisite	Data Structures, Information Systems
Course Outcome	After completion of this course, the students will be capable to use various Artificial Intelligence techniques in various applications.
Course Content	**Unit 1: Introduction to Artificial Intelligence** 1.1. What is AI 1.2. Applications of AI 1.3. Introduction to Expert System 1.4. Applications of expert systems **Unit 2: Knowledge Overview** 2.1. Definition and importance of knowledge 2.2. Overview knowledge representation 2.3. Overview of knowledge organization 2.4. Overview of knowledge Manipulation 2.5. Overview of Knowledge Acquisition **Unit 3: Representation and Search** 3.1. Structured Knowledge 3.1.1. Associative networks 3.1.2. Frame structures 3.1.3. Conceptual dependencies and scripts 3.2. Object oriented representation **Unit 4: Organization and Manipulation, Knowledge Acquisition** 4.1. Introduction to organization 4.2. Search techniques 4.2.1. Uninformed search 4.2.2. Informed search 4.2.3. Introduction to matching Techniques 4.3 Knowledge Acquisition 4.3.1. Knowledge learning types 4.3.2. General learning models 4.3.3. Performance of learning models **Unit 5: Expert System** 5.1. Advantages of Expert Systems 5.2. Characteristics of Expert Systems 5.3. Design of Expert Systems 5.3.1. Selecting Problem 5.3.2. Stages in Expert systems development 5.3.3. Errors in developments

	5.3.4. Expert System Software Engineering 5.3.5. Expert System Life Cycle
Reference Books	1. Introduction to Artificial Intelligence and Expert System by Dan W. Patterson, PHI (1999) 2. Artificial Intelligence – A Modern Approach (2nd Edition 2004) by Stuart J. Russell and Peter Norvig, Pearson Education 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) 5. Expert Systems Principles and Programming (3rd Edition) by Giarratano & Riley, Thomson (Vikas Pulishing House) 6. Introduction to Artificial Intelligence by Rajendra Akerkar, PHI
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 503: **Network Essentials and its Security**

Course Code	503
Course Title	**Network Essentials and its Security**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	To make students learn Network essentials and various security measures for the challenges to which the IT industry is exposed
Course Objective	To understand Network Management and its security
Pre-requisite	Computer Network, TCP/IP
Course Outcome	Students will be able to solve and determine best solutions for the challenging area of Network Security
Course Content	**Unit 1: Network Essentials** 1.1 Repeaters & Bridges 1.1.1 LAN Expansion 1.1.2 Repeaters 1.1.3 Bridges 1.1.4 How Bridges Work 1.1.5 Creating the routing table 1.1.6 Segmenting Network Traffic 1.1.7 Remote Bridges 1.1.8 Differentiating between bridges and repeaters 1.2 Routers & Gateways 1.2.1 Routers 1.2.2 How routers work 1.2.3 Routing benefits 1.2.4 Routing protocols 1.2.5 Routing V/S Bridging 1.2.6 B Routers 1.2.7 Gateways 1.2.8 How Gateways work 1.3 Network Administration 1.3.1 Bottlenecks 1.3.2 Simple Network Management Protocol 1.3.3 Data Protection 1.3.4 Backup Methods 1.3.5 Testing and Storage 1.3.6 Implementing a Backup System 1.3.7 Uninterruptible Power Suppliers 1.3.8 How Gateways work 1.3.9 Implementing Fault Tolerant Systems 1.3.10 RAID 1.3.11 Sector Sparing 1.4 Advance WAN Transmission 1.4.1 Overview 1.4.2 Multiplexing, Packet and Circuit Switching Networks 1.4.3 X.25 1.4.4 Asynchronous Transfer Mode (ATM) 1.4.5 ISDN 1.4.6 SONET 1.4.7 SMDS **Unit 2: Introduction to Network Security** **Unit 3: Cryptography Techniques** 3.1 Classical Cryptography

	3.2 Conventional Cryptography 3.2.1 DES 3.3 Public – key Cryptography 3.3.1 RSA 3.4 Digital Signatures 3.4.1 DSA **Unit 4: Security Services** 4.1 Message Integrity 4.2 Confidentiality and Authentication 4.3 Certification and Key Management 4.3.1 PKI **Unit 5: Network Security Applications** 5.1 IP Security 5.1.1 IPsec 5.2 Web Security 5.2.1 SSL, TLS, SET 5.3 Electronic Mail Security 5.3.1 PGP, S/MIME 5.4 SNMP Security **Unit 6: Access Control in Computer Networks** 6.1 Authentication Protocols and Services 6.1.1 Kerberos and X.509 6.2 Firewalls 6.3 Virtual Private Networks (VPNs) **Unit 7: System Security** 7.1 Intrusion detection 7.2 Viruses **Unit 8: Mobile System & E-Commerce Securities** 8.1 3G Security 8.2 E-Payment Systems 8.3 Fair Data Exchange
Reference Books	1. Cryptography and Network Security, 2/e, ISBN: 0-13-869017-0 - W. Stallings - Pearson Education, 1999 2. Network Security Essentials: Applications and Standards, 1/e, ISBN: 0-13-016093-8 - W. Stallings - Pearson Education, 2000 3. SSL and TLS: designing and building secure systems, ISBN: 0-201-61598-3 - E. Rescorla - Addison-Wesley, 2001 4. Implementing Secure Intranets and Extranets, ISBN: 0-89006-447-4 - K M Phaltankar - Artech House Publishers, 2000 5. Secure Electronic Commerce: Building the Infrastructure for Digital Signature and Encryption, ISBN: 0-13-027276-0 - W. Ford, and M. Baum - Prentice Hall, 2001 6. Security in Computing, ISBN: 0-13-185794-0, 2/e - C. P. Pfleeger - Prentice Hall, 1997 7. Building Internet Firewalls, 2/e, ISBN: 1-56592-871-7 - E. D. Zwicky, et al - O'Reilly, 2000 8. CDMA Cellular Mobile Communications & Network Security, ISBN: 0-13-598418-1 - M. Y. Rhee, - Prentice Hall, 1998 9. Journal of Computer Security 10. ACM Transactions on Information and System Security 11. ACM Conference on Computer and Communications Security 12. IEEE Symposium on Security and Privacy

	13. Internet documents - RFCs (Request for Comments) 14. Guide to Networking Essentials, Fourth Edition - Greg Tomsho, et al 15. Computer Networking Essentials - Debra Littlejohn Shinder 16. Networking Essentials: Hands-On, Self-Paced Training for Supporting Local and Wide Area Networks - Microsoft Corporation (Corporate Author) 17. Computer Network - A. S. Tanenbaum
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 504: **Advanced Database Administration**

Course Code	504
Course Title	**Advanced Database Administration**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	Understanding advanced database administration
Course Objective	To learn advanced database administration, database tuning and maintenance
Pre-requisite	RDBMS
Course Out come	After studying the course, students will be able to perform Database Administration
Course Content	**Unit 1. Oracle10g Instance creation and management** 1.1 Oracle Instance 1.2 Installing Oracle 1.3 Oracle Optimal Flexible Architecture (OFA) 1.4 Locating initialization, listener.ora & sqlnet.ora files 1.5 Finding the alert log 1.6 Common environment variables 1.7 Structures in an Oracle Instance 1.8 Oracle Memory Structures, SGA and PGA 1.9 Oracle Processes and their purposes 1.10 Startup, nomount, mount and open database commands **Unit 2. Oracle10g Database Architecture** 2.1 Oraclde10g management framework 2.1 Using the Database Creation Assistant (DBA) 2.3 Creating and dropping a database 2.4 Tablespaces 2.5 Tables and Indexes 2.6 Clusters 2.7 Partitioning of Tables and Indexes 2.8 Gathering and applying patches **Unit 3. Concurrency Management** 3.1 Transactions, serialization, locks and latches 3.2 Lock modes 3.3 Detecting and resolving lock conflicts 3.4 Managing deadlocks **Unit 4. Interfacing with Oracle** 4.1 Oracle transaction management 4.2 Using SQL*Plus and iSQL*Plus 4.3 Using embedded Oracle with Pro*C & Java 4.4 PL/SQL & Triggers 4.5 Pining PL/SQL packages & compiling PL/SQL 4.6 System-level triggers – startup trigger, logon trigger, PL/SQL error trigger **Unit 5. Oracle*Net** 5.1 Basic Network structure 5.2 Oracle*Net Files 5.3 Multi-threaded server 5.4 Create additional listeners 5.5 Create Oracle Net service aliases

5.6 Configure connect time failover
5.7 Oracle*Net names resolution

Unit 6. Tablespace Management Overview
6.1 Dictionary Managed Tablespaces
6.2 Locally Managed Tablespaces
6.3 Automatic Segment Space Management
6.4 Moving tablespaces online and offline

Unit 7. UNDO Tablespace Management
7.1 Use of undo segments
7.2 Creating an undo tablespace
7.3 User managed undo tablespaces
7.4 Automatic undo management
7.5 Monitor & Configure undo retention
7.6 Use the Undo Advisor
7.7 Size the undo tablespace

Unit 8. Oracle Utilities
8.1 Datapump - Import/export
8.2 SQL*Loader
8.3 Oracle Streams
8.4 Automatic Database Diagnostic Monitor
8.5 Automatic Tuning Optimizer
8.6 Automatic Shared Memory Tuning

Unit 9. Oracle Performance Tuning
9.1 Locate invalid and unusable objects
9.2 Gather SQL optimizer statistics with dbms_stats
9.3 Basic Oracle performance metrics
9.4 Use OEM and dbms_alert to set warning and critical alert thresholds
9.5 The SQL Tuning Advisor
9.6 The SQL Access Advisor
9.6 Interpreting server generated alerts
9.7 Oracle advisory utilities vdb_cache_advice, vshared pool_advice, v$pga_aggregate_target_advice
9.8 Using OEM performance screens
9.9 Fixing performance issues

Unit 10. User Management
10.1 Creating Users
10.2 Altering users
10.3 User Profiles
10.4 User resource groups
10.5 Granting privileges & roles
10.6 Auditing user activity with dbms_audit

Unit 11. Oracle Security
11.1 Password use in Oracle, Password encryption and password aging, External authentication, Using Single sign-on (SSO)
11.2 Object security
11.3 Virtual Private Databases (VPD) in Oracle
11.4 Oracle “grant execute” security
11.5 Use of Roles in Oracle
11.6 Register for security updates

Unit 12. Backup & Recovery

	12.1 Oracle backup & recovery planning 12.2 Parallel instance recovery 12.3 Basics of checkpoints, redo log files, and archived log files 12.4 Using ARCHIVELOG mode 12.5 Creating consistent Oracle backups 12.6 Online hot backups 12.7 Incremental Oracle backups 12.8 Automating database backups with dbms_scheduler 12.9 Monitor the flash recovery area 12.10 Recovering from loss of a Control file 12.11 Recovering from loss of a Redo log file 12.12 Recovering from loss of a system-critical data file 12.13 Recovering from loss of a non system-critical data file
Reference Books	1. Essentials : Oracle Database 10g by Rick Greenwald, Robert Stackowiak, Jonathan Stern, O'Reilly 2. Oracle High Performance Tuning for 9i and 10g by Gavin Powell, Digital Press 3. Oracle Database 10g, DBA Handbook by Loney, Kevin, Bryla, Bob, Oracle Press 4. Oracle Database 10g - The Complete Reference by Loney, Kevin, Oracle Press 5. Oracle Database 10g: A Beginner's Guide by Micheal Abbey, Ian Abramson Osborne, Oracle Press Series
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or 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 semester end University External examination

Course: 505: **Open Source Web Based Programming**

Course Code	505
Course Title	**Open Source Web Based Programming**
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to understand fundamentals of Open Source web based Programming. The course also imparts students learning about Open source web based scripting language PHP and Mysql database. It also includes MVC or Three tier architecture of web based programming and Javascript technology like ReactJS.
Course Objective	Student will learn fundamentals and advance topics of Open source Web technology
Pre-requisite	Knowledge of HTML, Javascript and SQL
Course Out come	After studying the course, students will be able to understand how Open source web technology works. They will also be able to create database driven Websites.
Course Content	**Unit 1 : Introduction to Open source Web based Programming** 1.1 Introduction to PHP & MySql 1.2 Installation of PHP and MySql 1.3 Language Characteristics & Features 1.4 Operators and Variables, Control Structures, Looping and Error handling 1.5 PHP functions 1.5.1 String Functions 1.5.2 Array Functions 1.5.3 Mathematical Functions 1.5.4 Graphics Library (GD Support) 1.5.5 Date and Time Functions 1.5.6 Misc. Function 1.6 State management Techniques 1.7 Object Oriented Features of PHP 1.7.1 Classes and Objects 1.7.2 Use of constructors 1.7.3 Serialization 1.7.4 Inheritance **Unit 2 : MySQL database server** 2.1 Configuring the MySQL Server 2.2 MySQL Tables, Displaying MySQL Database , Adding and removing user access 2.3 Database connection and data processing functions **Unit 3 : Advance PHP** 3.1 Ajax Basics 3.1.1HTTP Request and Response Fundamentals 3.1.2 The XMLHttpRequest Object XMLHttpRequest Methods 3.1.3 XMLHttpRequest Properties 3.1.4 Cross-Browser Usage Sending a Request to the Server 3.1.5 PHP and Ajax Client-Driven Communication 3.1.6 Server-Side Processing Expanding and Contracting Content 3.1.7 Form Validation 3.1.8 Ajax-Based Database Querying 3.2 XML 3.3 Web services

	Unit 4 : MVC 4.1 Introduction to MVC 4.2 CodeIgniter: Introduction, Features and Application Flow Chart 4.3 Controller 4.4 Views 4.5 Models 4.6 Helpers 4.7 Creating and Usage of Libraries and Helpers 4.8 URL Routing 4.9 Error Handling 4.10 Profiling Application **Unit 5 : Introduction to React JS** 5.1 What is React JS 5.2 Environment Setup 5.3 JSX and ES6 5.4 Components 5.5 Props and State 5.6 Components API and Lifecycle 5.7 Forms and Events 5.8 Difference between React JS and React Native
Reference Books	1. Beginning PHP, Apache, MySQL Web Development - Elizabeth Naramore, Jason Gerner , Yann Le Scouarnec,Jeremy Stolz,Michael K. Glass, Gary Mailer – Wrox Publication 2. Professional PHP Programming - Jesus Castagnetto ,Wrox Press Ltd 3. Beginning PHP and MySQL: From Novice to Professional - W. Jason Gilmore, Apress 4. Php: The Complete Reference - Steven Holzner, Tata Mcgraw Hill Education Private Limited 5. AJAX and PHP: Building Responsive Web Applications - Bogdan Brinzarea, Cristian Darie packtpub 6. CodeIgniter for Rapid PHP Application Development - David Upton ,packtpub 7. Professional CodeIgniter- Thomas Myer, Wrox Press Ltd 8. Learning React - Kirupa Chinnathambi , Paperback – 2018 9. Mastering React- Adam Horton and Ryan Vice, packtpub 10. Php manual – www. Php.com
Teaching Methodology	Class work, Discussion, Self Study, Seminars and/or 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 semester end University External examination

Course: 506: **Programming Skills XI**

Course Code	506
Course Title	**Programming Skills XI**
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement the Unix Internals with shell programming/IOT practically.
Course Objective	Learning to implement fundamentals and advanced topics of Unix Internals with Shell Scripting/IOT practically
Pre-requisite	Practical programming in desktop environment / Embedded Technology
Course Outcome	After studying the course, students will be able to practically work on advanced technology platforms of Unix Internals with Shell Scripting /IOT.
Course Content	Practical based on paper no 501. Separate journal to be prepared for this subject based on 501.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 507: **Programming Skills XII**

Course Code	507
Course Title	**Programming Skills XII**
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to understand the Networking and its security practically
Course Objective	Learning to implement Network and its security practically.
Pre-requisite	Network fundamentals
Course Outcome	After studying the course, students will be able to practically implement network and its security
Course Content	Practical based on paper no 503. Separate journal to be prepared for this subject 503.
Reference Books	-----
Teaching Methodology	Lab work, Practical Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 508: **Programming Skills XIII**

Course Code	508
Course Title	**Programming Skills XIII**
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to learn network administration
Course Objective	Students will learn administration of network practically
Pre-requisite	Networking fundamentals
Course Outcome	After studying the course, students will be able to practically perform administrative tasks of networks practically
Course Content	Practical based on paper no 504. Separate journal to be prepared for this subject 504.
Reference Books	-----
Teaching Methodology	Lab work, Practical Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

Course: 509: **Programming Skills XIV**

Course Code	509
Course Title	**Programming Skills XIV**
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2020
Purpose of Course	This course helps students to implement the basic and advanced concepts of PHP/MySql practically.
Course Objective	Learning to develop and deploy websites using PHP/MySql practically.
Pre-requisite	Basic scripting, programming, html.
Course Outcome	After studying the course, students will be able to practically develop dynamic websites using PHP/MySql.
Course Content	Practical based on paper no 505. Separate journal to be prepared for this subject based on 505.
Reference Books	-----
Teaching Methodology	Lab work, Practical Programming Exercises (to be documented in a separate journal), Self-study, and/or Assignment
Evaluation Method	30% Internal assessment is based on Lab attendance, practical test, practical internal examination etc. 70% assessment is based on semester end University External practical examination

MCA

6th Sem.

Course: 601: **Seminar**

Course Code	601
Course Title	**Seminar**
Credit	6
Review / Revision	June 2020

- The students are required to prepare a seminar on a relevant topic concerning the subject of interest of the student; as well as latest technology.
- The students must prepare documentation of the seminar.
- At the end of the semester, the students have to submit the seminar reports in spiral bounded form to the institution.
- Seminar Completion Certificate issued by the institute is mandatory for appearing in Seminar Presentations.
- The Seminar Presentation will be conducted as per the University exam schedule.

The students have to submit the following reports at the institution:

1. Seminar Topic Chosen
2. Institution Certificate for Seminar

Course: 602: **Project**

Course Code	602
Course Title	**Project**
Credit	24

- The students are required to carry out full time software development project in a company.
- The students must prepare documentation of the project completed as per the guidelines given by the institute.
- At the end of the semester, the students have to submit the project reports in bounded form to the institution.
- Project Completion Certificate issued by the institute is mandatory for appearing in Project Presentation and Viva – Voce.
- The Project Presentation and Viva – Voce will be conducted as per the University exam schedule.

The students have to submit the following reports at the institution:

1. Project Joining Report
2. Progress Reports
3. Project Completion Certificate from the company
4. Institution Certificate for Project
5. Non-disclosure of Source Code Certificate (In case the student is unable to submit project source code)