



**-: પરિપત્ર :-**

બી.સી.એ./બી.એસસી.(કોમ્પ્યુટર સાયન્સ) તથા એમ.એસસી.(કોમ્પ્યુટર એપ્લીકેશન)તથા એમ.સી.એ.નો અભ્યાસક્રમ ચલાવતી સંલગ્ન કોલેજોના આચાર્યશ્રીઓને તથા ડીપાર્ટમેન્ટના વડાશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૧-૨૨ થી અમલમાં આવનાર B.C.A. (2<sup>nd</sup> Year), B.Sc.(Computer Science) દ્વિતિય વર્ષ, M.Sc.(C A) દ્વિતિય વર્ષ, M.C.A. દ્વિતિય વર્ષના અભ્યાસક્રમ અંગે તા.૦૭/૦૧/૨૦૨૧ની સભામાં નીમેલ પેટાસમિતિએ તૈયાર કરેલ અભ્યાસક્રમ કોમ્પ્યુટર સાયન્સ અભ્યાસસમિતિ તથા કોમ્પ્યુટર સાયન્સ એન્ડ ઈન્ફોર્મેશન ટેકનોલોજી વિદ્યાશાખાની તા.૧૦/૦૫/૨૦૨૧ની સભાનાં ઠરાવ ક્રમાંક:૨ અન્વયે સ્વીકારી તે મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલે તેની તા. ૨૧/૦૫/૨૦૨૧ ની સભાના ઠરાવ ક્રમાંક : ૦૨ અન્વયે મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્ઉપરાંત તેનો અમલ કરવો.

**કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસસમિતિ તથા કોમ્પ્યુટર સાયન્સ વિદ્યાશાખાની તા.૧૦/૦૫/૨૦૨૧ની સભાનાં ઠરાવ ક્રમાંક: ૨**

:: આથી ઠરાવવામાં આવે છે કે, કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસસમિતિની તા.૭/૦૧/૨૧ની સભામાં નીમેલ પેટાસમિતિએ તૈયાર કરેલ નીચે મુજબ નાં નવા અભ્યાસક્રમ મંજૂર કરી તે મંજૂર કરવા એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.

- (૧) B.C.A. (2<sup>nd</sup> Year) નો અભ્યાસક્રમ સબકમીટીએ તૈયાર કરેલ અભ્યાસક્રમને સ્વીકારી ફેકલ્ટીને ભલામણ કરવામાં આવે છે.
- (૨) B.Sc. (Computer Science) દ્વિતિય વર્ષનો અભ્યાસક્રમ સબકમીટીએ તૈયાર કરેલ અભ્યાસક્રમને સ્વીકારી ફેકલ્ટીને ભલામણ કરવામાં આવે છે.
- (૩) M.Sc. (CA) દ્વિતિય વર્ષનો અભ્યાસક્રમ સબકમીટીએ તૈયાર કરેલ અભ્યાસક્રમને સ્વીકારી ફેકલ્ટીને ભલામણ કરવામાં આવે છે.
- (૪) M.C.A. દ્વિતિય વર્ષના અભ્યાસક્રમ સબકમીટીએ તૈયાર કરેલ અભ્યાસક્રમને સ્વીકારી ફેકલ્ટીને ભલામણ કરવામાં આવે છે.

**એકેડેમિક કાઉન્સિલની તા.૨૧/૦૫/૨૦૨૧ની ઠરાવ ક્રમાંક:૦૨**

:: આથી ઠરાવવામાં આવે છે કે, કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસસમિતિ તથા કોમ્પ્યુટર સાયન્સ વિદ્યાશાખાએ તેની તા. ૧૦/૦૫/૨૦૨૧ ની સભાના ઠરાવ ક્રમાંક : ૨ અન્વયે સ્વીકારેલ નીચે મુજબનાં અભ્યાસક્રમો મંજૂર કરવામાં આવે છે.

- (૧) B.C.A. (2<sup>nd</sup> Year) નો અભ્યાસક્રમ
- (૨) B.Sc. (Computer Science) દ્વિતિય વર્ષનો અભ્યાસક્રમ
- (૩) M.Sc. (CA) દ્વિતિય વર્ષનો અભ્યાસક્રમ
- (૪) M.C.A. દ્વિતિય વર્ષના અભ્યાસક્રમ

બિડાણ: ઉપર મુજબ

ક્રમાંક : એક./પરિપત્ર/૭૦૧૫/૨૧  
તા.૨૮/૦૫/૨૦૨૧

ઈ.ચા.કુલસચિવ

પ્રતિ,

- ૧) બી.સી.એ./બી.એસસી.(કોમ્પ્યુટર સાયન્સ) તથા એમ.એસસી.(કોમ્પ્યુટર એપ્લીકેશન) નો અભ્યાસક્રમ ચલાવતી સંલગ્ન કોલેજોના આચાર્યશ્રીઓ તથા ડિપાર્ટમેન્ટના વડાશ્રીઓ.
- ૨) ડીનશ્રી, કોમ્પ્યુટર સાયન્સ એન્ડ ઈન્ફોર્મેશન ટેકનોલોજી વિદ્યાશાખા
- ૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

# Veer Narmad South Gujarat University

## Teaching and Evaluation Scheme

### MCA 3rd Semester (Web Group)

Course Code	Title	Teaching per week		Course Credits	University Exam		Internal Exam	Total Marks
		Theory	Practical		Duration	Marks		
301	Internet of Things	4	0	4	3 Hrs	70	30	100
	Machine Learning							
302	Design Patterns	4	0	4	3 Hrs	70	30	100
303	Advanced Web Technologies	4	0	4	3 Hrs	70	30	100
	Advanced Java Programming							
304	Full Stack Technology	4	0	4	3 Hrs	70	30	100
305	Open Source Web Based Programming	4	0	4	3 Hrs	70	30	100
306	Programming Skills VIII	0	2	2	2 Hrs	70	30	100
307	Programming Skills IX	0	3	3	2 Hrs	70	30	100
308	Programming Skills X	0	2	2	2 Hrs	70	30	100
309	Programming Skills XI	0	3	3	2 Hrs	70	30	100

### MCA 3rd Semester (Database Group)

Course Code	Title	Teaching per week		Course Credits	University Exam		Internal Exam	Total Marks
		Theory	Practical		Duration	Marks		
301	Internet of Things	4	0	4	3 Hrs	70	30	100
	Machine Learning							
302	Design Patterns	4	0	4	3 Hrs	70	30	100
303	ERP Using SAP	4	0	4	3 Hrs	70	30	100
	NoSQL Databases							
304	Advanced Database Administration	4	0	4	3 Hrs	70	30	100
305	Data Warehousing and Data Mining	4	0	4	3 Hrs	70	30	100
	Big Data							
306	Programming Skills VIII	0	2	2	2 Hrs	70	30	100
307	Programming Skills IX	0	3	3	2 Hrs	70	30	100
308	Programming Skills X	0	2	2	2 Hrs	70	30	100
309	Programming Skills XI	0	3	3	2 Hrs	70	30	100

## MCA 3rd Semester (Network Group)

Course Code	Title	Teaching per week		Course Credits	University Exam		Internal Exam	Total Marks
		Theory	Practical		Duration	Marks		
301	Internet of Things	4	0	4	3 Hrs	70	30	100
	Machine Learning							
302	Design Patterns	4	0	4	3 Hrs	70	30	100
303	Network Essential & its Security	4	0	4	3 Hrs	70	30	100
304	Network Administration	4	0	4	3 Hrs	70	30	100
305	Wireless Network & Mobile Computing	4	0	4	3 Hrs	70	30	100
306	Programming Skills VIII	0	2	2	2 Hrs	70	30	100
307	Programming Skills IX	0	3	3	2 Hrs	70	30	100
308	Programming Skills X	0	2	2	2 Hrs	70	30	100
309	Programming Skills XI	0	3	3	2 Hrs	70	30	100

## MCA 3rd Semester (General Group)

Course Code	Title	Teaching per week		Course Credits	University Exam		Internal Exam	Total Marks
		Theory	Practical		Duration	Marks		
301	Internet of Things	4	0	4	3 Hrs	70	30	100
	Machine Learning							
302	Design Patterns	4	0	4	3 Hrs	70	30	100
303	Network Essential & its Security	4	0	4	3 Hrs	70	30	100
304	Advanced Database Administration	4	0	4	3 Hrs	70	30	100
305	Open Source Web Based Programming	4	0	4	3 Hrs	70	30	100
306	Programming Skills VIII	0	2	2	2 Hrs	70	30	100
307	Programming Skills IX	0	3	3	2 Hrs	70	30	100
308	Programming Skills X	0	2	2	2 Hrs	70	30	100
309	Programming Skills XI	0	3	3	2 Hrs	70	30	100

## MCA 4<sup>th</sup> Semester

### Teaching and Evaluation Scheme

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

**MCA 3rd Sem.**

**(Web**

**Group)**

**Course: 301: Internet of Things (IoT)**  
(Elective)

Course Code	301
Course Title	<b>Internet of Things (IoT)</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 - <ol style="list-style-type: none"> <li>1. To make student understand IoT</li> <li>2. To understand the working of Micro-Controller &amp; Micro-Computer</li> <li>3. To explain various types of sensors</li> <li>4. To introduce students with Programming in IoT</li> </ol>
Pre-requisite	C , C++
Course Outcome	After studying this course, student will be able to understand how Micro-Controller & Micro-Computer works. It will also help them 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	<p><b>Unit 1: Introduction to IoT</b></p> <ol style="list-style-type: none"> <li>1.1 What is IoT</li> <li>1.2 IoT Applications</li> <li>1.3 IoT Privacy and Security <ol style="list-style-type: none"> <li>1.3.1 Identification in Distributed Environment</li> <li>1.3.2 Device Authentication</li> </ol> </li> <li>1.4 IoT Botnet</li> </ol> <p><b>Unit 2: Networking and Communication</b></p> <ol style="list-style-type: none"> <li>2.1 Basics of Wireless Networking <ol style="list-style-type: none"> <li>2.1.1 CSMA/CA</li> </ol> </li> <li>2.2 IoT Network Protocols <ol style="list-style-type: none"> <li>2.2.1 BLE, Zigbee, LoRaWAN, RFID</li> </ol> </li> <li>2.3 IoT Data Protocols <ol style="list-style-type: none"> <li>2.3.1 CoAP, MQTT, XMPP, DDS</li> </ol> </li> </ol> <p><b>Unit 3: Sensors</b></p> <ol style="list-style-type: none"> <li>3.1 Introduction to Sensors</li> <li>3.2 Types of Sensors &amp; their working</li> <li>3.3 Wireless Sensor Network <ol style="list-style-type: none"> <li>3.3.1 Introduction to WSN</li> <li>3.3.2 Applications</li> <li>3.3.3 Characteristics</li> <li>3.3.4 Challenges</li> <li>3.3.5 Components</li> </ol> </li> <li>3.4 Wireless Adhoc Network Vs Wireless Sensor Network</li> </ol> <p><b>Unit 4: Micro-Controller: Arduino, NodeMCU</b></p> <ol style="list-style-type: none"> <li>4.1 Introduction to Microcontrollers</li> <li>4.2 Arduino IDE</li> <li>4.3 Arduino Architecture</li> <li>4.4 Arduino Pin Diagram</li> <li>4.5 Introduction to NodeMCU</li> </ol>

	<p>4.6 NodeMCU Specifications and Applications</p> <p>4.7 NodeMCU ESP8266 Pinout</p> <p><b>Unit 5: IoT App Interaction &amp; Introduction to Raspberry Pi</b></p> <p>5.1 Uploading sensor data to server</p> <p>5.2 Reading sensor data from server</p> <p>5.3 Controlling IoT device and components from Mobile or Web</p> <p>5.4 Introduction to Microcomputers</p> <p>5.5 Raspberry Pi Architecture</p> <p>5.6 Raspberry Pi Pinout</p>
Reference Books	<ol style="list-style-type: none"> <li>1) Getting Started with Internet of Things – By Cuno Pfister, O’Reilly</li> <li>2) Learning Internet of Things – By Peter Waher , Packt Publication</li> <li>3) Internet of Things : A Hands-on Approach – By Arshdip Bahga and Vijay Madisetti</li> <li>4) IoT Governance, Privacy and Security Issues, IERC</li> <li>5) IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Cisco Press</li> <li>6) Fundamentals of IoT Communication Technologies, Springer</li> <li>7) Microcontrollers – Architecture, Programming, Interfacing and system design – By Raj Kamal , Pearson</li> <li>8) Exploring C for Microcontrollers : A hands on approach, Springer</li> <li>9) Arduino for Dummies, Wiley</li> <li>10) Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media</li> <li>11) ESP8266: Get Started With ESP8266 Programming NodeMCU Using Arduino IDE, Createspace Independent Pub</li> <li>12) Internet of Things Projects with ESP32, Packt Publishing Limited</li> <li>13) Microprocessor Architecture, Programming and Applications with the 8085 - By Ramesh Gaonkar , Penram International Publishing</li> <li>14) Raspberry Pi for Dummies , Wiley</li> <li>15) Raspberry Pi User Guide – By Eben Upton and Garath Halfacree, Wiley</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

**Course: 301: Machine Learning**  
(Elective)

Course Code	301
Course Title	<b>Machine Learning (ML)</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	This course is an introduction for students to ML. The course also gives students an idea about various methods and algorithms of Machine Learning and application development of ML.
Course Objective	The objective of the course is – 1. To make student understand ML 2. To understand the various Machine Learning method 3. To explain various algorithms used in Machine learning 4. To introduce students with Programming in ML
Pre-requisite	Basics of Linear Algebra, Statistics and Mathematics, Python Programming
Course Outcome	After studying this, student will be able to understand how ML works. This course will also help students to appreciate the role of ML in industry environment. After successful completion, students will be able to work with different types of ML algorithms and ML based application development.
Course Content	<p><b>Unit 1 : Introduction</b></p> 1.1. Definition of Machine Learning 1.2 Types of Machine Learning : Supervised , Unsupervised and Semi-supervised 1.3 Applications and tools of Machine Learning (Scikit learn library) 1.4 Data Pre-processing, Selecting a model and training a model 1.5 Evaluating a performance of model and improving performance
	<p><b>Unit 2 : Data Wrangling</b></p> 2.1 Definition and goal of Data Wrangling 2.2 Importance of Data Wrangling 2.3 Data Pre-processing and Data Cleaning 2.3.1 Data Cleaning 2.3.2 Data Transformation 2.3.3 Data Reduction 2.3.4 Data Discretization 2.3.5 Feature Selection 2.4 Data Visualization
	<p><b>Unit 3 : Supervised Learning</b></p> 3.1 Supervised Learning : Classification and Regression 3.2 Regression 3.2.1 Simple and Multiple Regression 3.2.2 Linear Regression 3.2.3 Gradient Decent 3.2.4 Logistic Regression 3.3 Classification Algorithms : 3.3.1 K-nearest Neighbour 3.3.2 Support Vector Machines

	<p>3.3.3 Decision Trees</p> <p>3.3.4 Naïve Bayes Classifier</p> <p>3.4 Introduction to Support Vector Machine</p> <p><b>Unit 4 : Neural Network</b></p> <p>4.1 Introduction to Neural Network</p> <p>4.2 Architecture of Neural Network</p> <p>4.3 Feedforward network and Backpropagation with example</p> <p>4.4 Applications of Neural Network</p> <p><b>Unit 5 : Unsupervised Learning</b></p> <p>5.1 Introduction to Unsupervised learning</p> <p>5.2 Clustering</p> <p>    5.2.1 Selection of Clusters</p> <p>    5.2.2 Algorithms :</p> <p>        5.2.2.1 K – means clustering</p> <p>        5.2.2.2 Hierarchical Clustering</p> <p>5.3 Association Rule Learning</p> <p>    5.3.1 Algorithms :</p> <p>        5.3.1.1 FP- Growth</p> <p>        5.3.1.2 Apriori Algorithm</p>
Reference Books	<ol style="list-style-type: none"> <li>1. “Machine Learning” by Tom M. Mitchell, McGraw Hill</li> <li>2. “Understanding Machine Learning” by Shai Shalev-Shwartz, Shai Ben-David</li> <li>3. “Machine Learning” by Anuradha Srinivasaraghavan, Vincy Joseph</li> <li>4. “Machine Learning using Python” by U Dinesh Kumar Manaranjan Pradhan</li> <li>5. “Real-World Machine Learning” by Henrik Brink, Joseph Richards, Mark Fetherolf</li> <li>6. “Python Machine Learning” by Sebastian Raschka and Vahid Mirjalili</li> <li>7. “Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems” by Aurelien Geron</li> <li>8. “Machine Learning in Action” by Peter Harrington</li> <li>9. “Introduction to Machine Learning with Python : A Guide for Data Scientists” by Andreas C. Muller, Sarah Guido</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 302: Design Patterns

Course Code	302
Course Title	<b>Design Patterns</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	The purpose of the course is to make student understand how Patterns can be implemented in various object oriented programming languages to solve real world problems.
Course Objective	The objective of the course is - <ol style="list-style-type: none"> <li>1. To study various Design Patterns</li> <li>2. How these Patterns can be used to design better systems through Object Oriented Programming Languages</li> </ol>
Pre-requisite	Object Oriented Programming, Software Engineering
Course Outcome	After completion of this course, the student will be capable of implementing various Design Patterns in different Object Oriented Programming languages.
Course Content	<p><b>Unit -1 Creational Patterns</b></p> <ol style="list-style-type: none"> <li>1.1 Singleton Pattern</li> <li>1.2 Prototype Pattern</li> <li>1.3 Builder Pattern</li> <li>1.4 Factory Method Pattern</li> <li>1.5 Abstract Factory Pattern</li> </ol> <p><b>Unit-2 Structural Patterns</b></p> <ol style="list-style-type: none"> <li>2.1 Proxy Pattern</li> <li>2.2 Decorator Pattern</li> <li>2.3 Adapter Pattern</li> <li>2.4 Façade Pattern</li> <li>2.5 Flyweight Pattern</li> <li>2.6 Composite Pattern</li> <li>2.7 Bridge Pattern</li> </ol> <p><b>Unit-3 Behavioural Pattern</b></p> <ol style="list-style-type: none"> <li>3.1 Visitor Pattern</li> <li>3.2 Observer Pattern</li> <li>3.3 Strategy Pattern</li> <li>3.4 Template Method Pattern</li> <li>3.5 Command Pattern</li> <li>3.6 Iterator Pattern</li> <li>3.7 Memento Pattern</li> <li>3.8 State Pattern</li> <li>3.9 Mediator Pattern</li> <li>3.10 Interpreter Pattern</li> </ol> <p><b>Unit-4 Additional Design Patterns</b></p> <ol style="list-style-type: none"> <li>4.1 Simple Factory Pattern</li> <li>4.2 Null Object Pattern</li> <li>4.3 MVC Pattern</li> </ol> <p><b>Unit-5 Pattern Applicability</b></p> <ol style="list-style-type: none"> <li>5.1 Security Patterns Repository</li> <li>5.2 Patterns for Agile Development</li> <li>5.3 Restful Service Patterns</li> <li>5.4 Solution with semaphore</li> <li>5.5 Patterns and Pattern combination in practice</li> <li>5.6 Big Ball of Mud</li> </ol>

	<b>Self-Study :</b> Pattern Languages
Reference Books	<ol style="list-style-type: none"> <li>1. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph, John, Addison Wesley</li> <li>2. Head First Design Patterns, Eric Freeman, O'Reilly</li> <li>3. Design Patterns in C#, Vaskaran Sarcar, Apress</li> <li>4. Design Patterns in Modern C++, Reusable Approaches for Object-Oriented Software Design, Dmitri Nesteruk, Apress</li> <li>5. Modern C++ design: generic Programming and design patterns applied, Alexendrescu, Andrei, Addison-Wesley</li> <li>6. Java Design Patterns: A Hands-on Experience with Real-World Examples, Vaskaran Sarcar, Apress</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30 % internal assessment and 70% external assessment

**Course: 303: Advanced Web Technologies**  
(Elective)

Course Code	303
Course Title	<b>Advanced Web Technologies</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2021
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, HTML and C# desirable
Course Out come	Students will be able to development web application using ASP .Net
Course Content	<p><b>Unit : 1 : Introduction to ASP.NET</b></p> <ol style="list-style-type: none"> <li>1.1. Overview of ASP.NET</li> <li>1.2. Page Class and Page Life Cycle</li> <li>1.3. Web Configuration files</li> <li>1.4. Exception Handling</li> <li>1.5. Error Pages</li> <li>1.6. ASP.NET State Management</li> <li>1.7. Introduction to Caching</li> </ol> <p><b>Unit : 2 : ASP.NET Controls</b></p> <ol style="list-style-type: none"> <li>2.1 Web Controls <ol style="list-style-type: none"> <li>2.1.1 Common Web Server Controls</li> <li>2.1.2 Specialized Web Server Controls</li> <li>2.1.3 Table, Image, FileUpload</li> <li>2.1.4 PostBack / Auto PostBack</li> </ol> </li> <li>2.2 Validation and Rich Controls</li> <li>2.3 Website Navigation Controls <ul style="list-style-type: none"> <li>- Sitemap, Treeview, Menu Controls</li> </ul> </li> <li>2.4 ASP.NET AJAX Controls <ol style="list-style-type: none"> <li>2.4.1 Introduction</li> <li>2.4.2 Server Callbacks / Script Manager</li> <li>2.4.3 ASP.NET AJAX Server Controls</li> <li>2.4.4 UpdatePanel</li> </ol> </li> </ol> <p><b>Unit : 3 : ASP .NET Web Application with Database</b></p> <ol style="list-style-type: none"> <li>3.1. ADO.NET Architecture</li> <li>3.2. Direct Data Access</li> <li>3.3. Disconnected Data Access</li> <li>3.4. Data Binding &amp; Data Controls <ol style="list-style-type: none"> <li>3.4.1. Single-view, Repeated-Value, Data Source</li> <li>3.4.2. Grid view ,Detail View, Form View</li> <li>3.4.3. Data Repeater Control</li> </ol> </li> <li>3.5. LINQ <ol style="list-style-type: none"> <li>3.5.1. LINQ Language Features</li> <li>3.5.2. LINQ to Objects</li> <li>3.5.3. LINQ to SQL</li> </ol> </li> </ol> <p><b>Unit : 4 : ASP .NET - MVC , WCF Services &amp; API</b></p> <ol style="list-style-type: none"> <li>4.1. ASP.NET MVC <ol style="list-style-type: none"> <li>4.1.1. MVC Architecture</li> <li>4.1.2. URL Routing Engine</li> <li>4.1.3. Wiring Controller, Model, and View</li> <li>4.1.4. Data Access</li> <li>4.1.5. Introduction to Entity Framework</li> </ol> </li> <li>4.2. WCF Services <ol style="list-style-type: none"> <li>4.2.1. Introduction to Web Services</li> <li>4.2.2. RESTful API</li> </ol> </li> </ol>

	<p>4.2.3. Working with WCF Services</p> <p>4.3. API</p> <p>4.3.1. Introduction to JSON</p> <p>4.3.2. Web API</p> <p>4.3.3. API Creation and Consumption</p> <p><b>Unit : 5 : ASP.NET CORE</b></p> <p>5.1. Overview of C#.NET CORE</p> <p>5.2. .NET CORE Assemblies and Libraries</p> <p>5.3. Pattern Matching</p> <p>5.4. Tuples and Deconstruction</p> <p>5.5. Local/Nested Functions</p> <p>5.6. NuGet Package</p>
Reference Book	<ol style="list-style-type: none"> <li>1. Professional ASP.NET, Wrox Publication</li> <li>2. ASP.NET – From Novice to Professional, Wrox Publication</li> <li>3. ASP.NET Bible, By Mridula Parihar</li> <li>4. Beginning ASP.NET 4.5, Wrox Publication</li> <li>5. ASP.NET MVC with Entity Framework and CSS, APress</li> <li>6. Programming Microsoft ASP.NET, Microsoft Press</li> <li>7. Beginning AJAX with ASP.NET, Wrox Publication</li> <li>8. Professional ASP.NET MVC 5, Wrox Publication</li> <li>9. Professional C# 7 and .NET Core 2.0 , Wrox Publication</li> <li>10. ASP.NET Core 2 Fundamentals, Packt Publication</li> <li>11. Pro ASP.NET MVC 5, Apress</li> <li>12. Programming ASP.NET Core, Microsoft Press</li> <li>13. Pro C# 7 with .NET and .NET Core, Apress</li> <li>14. Pro ASP.NET Core MVC by Adam Freeman, Springer, 2016</li> </ol>
Teaching Methodology	Classroom, seminar and assignment
Evaluation Method	As per University rules

**Course: 303: Advanced Java Programming**  
(Elective)

Course Code	303
Course Title	<b>Advanced Java Programming</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2021
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	<p><b>Unit 1: Advance JDBC (Java Database Connectivity)</b></p> <ol style="list-style-type: none"> <li>1.1 Types of JDBC Drivers</li> <li>1.2 Connecting to databases like Access, MySQL, SqlServer, Oracle</li> <li>1.3 Interacting with Database using SQL Queries</li> <li>1.4 JDBC Objects: Connection, Resultset, Statement, Metadata</li> <li>1.5 More JDBC Objects: DataSource, RowSet, RowSet events</li> <li>1.6 Calling Stored Procedures</li> <li>1.7 Managing Transactions</li> <li>1.8 JDBC Connection Pooling</li> <li>1.9 Handling Errors/Warning</li> </ol> <p><b>Unit 2: Java Servlets</b></p> <ol style="list-style-type: none"> <li>2.1 Introduction to Servlets</li> <li>2.2 Servlet Lifecycle</li> <li>2.3 Handling HTTP GET and POST requests</li> <li>2.4 Invoking other web resources</li> <li>2.5 Maintaining client state</li> <li>2.6 Servlet Annotations</li> <li>2.7 Servlet Filter</li> <li>2.8 File Upload</li> </ol> <p><b>Unit 3: Java Server Pages(JSP), JSTL (Standard Tag Library) &amp; EL</b></p> <ol style="list-style-type: none"> <li>3.1 Introduction to JSP, page lifecycle</li> <li>3.2 JSP Elements – directives, scriptlet, action</li> <li>3.3 Implicit JSP objects</li> <li>3.4 Using JavaBeans in JSP, Session Tracking</li> <li>3.5 JSTL – Using Java Standard Tag Library</li> <li>3.6 JSTL Core &amp; Database tags</li> <li>3.7 Introduction to EL (Expression Language)</li> <li>3.8 EL implicit objects</li> </ol> <p><b>Unit 4: Web Services with XML &amp; JSON</b></p> <ol style="list-style-type: none"> <li>4.1 Introduction to Web Services</li> <li>4.2 Building XML based web services with JAX-WS</li> <li>4.3 Building Restful web services with JAX-RS</li> <li>4.4 Reading/Writing XML files in Java (JAXP)</li> <li>4.5 Introduction to AJAX</li> </ol>

	<p><b>Unit 5: JPA, EJB &amp; MVC Introduction</b></p> <p>5.1 Introduction to Java Persistence API (JPA)</p> <p>5.2 Entity Beans &amp; Session Beans</p> <p>5.3 Overview of MVC Framework</p> <p>5.4 Spring Architecture</p> <p>5.5 Spring XML Configuration</p> <p>5.6 Aspect oriented programming</p>
Reference Books	<ol style="list-style-type: none"> <li>1. Java EE Tutorial Basic Concepts by Oracle Corporation</li> <li>2. Beginning Java™ EE Platform with GlassFish™ : From Novice to Professional by Antonio Goncalves</li> <li>3. Beginning EJB 3 Application Development From Novice to Professional by Raghuram R. Kodali and Jonathan Wetherbee with Peter Zdrozny, Apress Publication</li> <li>4. Pro JPA 2: Mastering the Java™ Persistence API</li> <li>5. Head First Servlets and JSP By: Bryan Basham, Kathy Sierra, Bert Bates Publisher: 'Reilly Media</li> <li>6. Core Servlets and JSP Pages: Author Marty Hall , Larry Brown, Sun Micro System</li> <li>7. Java Servlet &amp; JSP Cookbook by Bruce W. Perry O; reilly Publication</li> <li>8. Beginning JSP™, JSF™ and Tomcat™ Web Development: From Novice to Professional by Giulio Zamboni and Michael Sekler</li> <li>9. JAVA Complete Reference , TMH Publication</li> <li>10. Professional Java Development with Spring Framework , Wrox Publication</li> </ol>
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 304: Full Stack Technology

Course Code	304
Course Title	<b>Full Stack Technology</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	The purpose of the course is to make the students capable of developing full stack web applications.
Course Objective	The objective of the course is to make student understand full stack development
Pre-requisite	HTML, CSS, Front-end Scripting
Course Outcome	After completion of this course, the students will be able to design and develop Full Stack web applications
Course Content	<p><b>Unit 1: Introduction</b></p> <ul style="list-style-type: none"> <li>1.1 JavaScript <ul style="list-style-type: none"> <li>1.1.1 Execution Context and Call Stack</li> <li>1.1.2 Hoisting in JavaScript</li> <li>1.1.3 Spread Operator</li> <li>1.1.4 Scope Chain, Temporal Dead Zone</li> <li>1.1.5 Block Scope, Shadowing</li> <li>1.1.6 Closures</li> </ul> </li> <li>1.2 Full Stack Technology</li> </ul> <p><b>Unit 2: React.js</b></p> <ul style="list-style-type: none"> <li>2.1 React Introduction <ul style="list-style-type: none"> <li>2.1.1 What is React</li> <li>2.1.2 What is a Component</li> <li>2.1.3 JSX Overview</li> </ul> </li> <li>2.2 create-react-app <ul style="list-style-type: none"> <li>2.2.1 Understanding basics of react app</li> </ul> </li> <li>2.3 Understanding virtual DOM, SPA</li> <li>2.4 Components <ul style="list-style-type: none"> <li>2.4.1 Class Components</li> <li>2.4.2 Functional Components</li> <li>2.4.3 Parent, Child Components</li> <li>2.4.4 Conditional Rendering</li> <li>2.4.5 State, setState Method</li> <li>2.4.6 Props</li> </ul> </li> <li>2.5 Event Handling in React <ul style="list-style-type: none"> <li>2.5.1 Event Handling in Class Components</li> <li>2.5.2 Event Handling in Functional Components</li> </ul> </li> <li>2.6 Lifecycle <ul style="list-style-type: none"> <li>2.6.1 Class Component Life Cycle Methods</li> </ul> </li> <li>2.7 React Hooks <ul style="list-style-type: none"> <li>2.7.1 What is a React Hook</li> <li>2.7.2 useState Hook</li> <li>2.7.3 useEffect Hook</li> </ul> </li> <li>2.8 Building forms in React</li> <li>2.9 React Router</li> <li>2.10 Controlled vs Uncontrolled Components</li> <li>2.11 State Management <ul style="list-style-type: none"> <li>2.11.1 Single Source of Truth</li> <li>2.11.2 Lifting State Up</li> <li>2.11.3 Prop Drilling</li> <li>2.11.4 useContext</li> <li>2.11.5 Redux</li> </ul> </li> </ul>

	<p>2.12 HTTP Methods  2.12.1 Fetch  2.12.2 Axios</p> <p><b>Unit 3: Node.js &amp; Express.js</b>  3.1 Introduction to Node.js  3.2 Creating a Simple Server  3.3 Response types - HTML, JSON  3.4 Modules  3.5 NPM  3.6 Introduction to Express.js  3.7 Express Params and Query String  3.8 Express Router</p> <p><b>Unit 4: Mongo DB</b>  4.1 SQL/NoSQL landscape  4.2 Document Vs. Other types of Storage  4.3 MongoDB feature set  4.4 Introduction to BSON and JSON  4.5 Simple Queries  4.6 Connecting with Node JS  4.6.1 Inserts and Retrievals  4.6.2 Updates and Deletes</p> <p><b>Unit 5: MERN &amp; Deployment</b>  5.1 Connecting React and Node  5.2 Building an application in MERN  5.3 Github and CI/CD  5.4 Deploy using Netlify / Heroku</p>
Reference Books	<ol style="list-style-type: none"> <li>1. Eloquent JavaScript: A Modern Introduction to Programming, No Starch Press</li> <li>2. You Don't Know JS, Shroff/O'Reilly</li> <li>3. The Road to Learn React: Your Journey to Master Plain Yet Pragmatic React.js, Zaccheus Entertainment</li> <li>4. React Explained: Your Step-by-Step Guide to React, OS Training, LLC</li> <li>5. Beginning React, Greg Lim</li> <li>6. Learning React: Functional Web Development with React and Redux, Shroff/O'Reilly</li> <li>7. Learn React Hooks: Build and refactor modern React.js applications using Hooks, Packt Publishing Limited</li> <li>8. Pro React, Apress</li> <li>9. Web Development with Node and Express: Leveraging the JavaScript Stack, O'Reilly Media</li> <li>10. Express in Action: Writing, building, and testing Node.js applications, Manning Publications</li> <li>11. Beginning Node.js, Express &amp; MongoDB Development, Greg Lim</li> <li>12. MongoDB: The Definitive Guide - Powerful and Scalable Data Storage, Shroff/O'Reilly; Third edition</li> <li>13. Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js, Packt Publishing Limited</li> <li>14. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Apress</li> </ol>
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: 305: Open Source Web Based Programming

Course Code	305
Course Title	<b>Open Source Web Based Programming</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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.
Course Objective	Student will learn fundamentals and advance topics of Open source Web technology
Pre-requisite	Knowledge of HTML 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	<p><b>Unit 1 : Introduction to Open source Web based Programming</b></p> <ul style="list-style-type: none"> <li>1.1 Introduction to PHP &amp; MySql</li> <li>1.2 Installation of PHP and MySql</li> <li>1.3 Language Characteristics &amp; Features</li> <li>1.4 Operators and Variables, Control Structures, Looping and Error handling</li> <li>1.5 PHP functions <ul style="list-style-type: none"> <li>1.5.1 String Functions</li> <li>1.5.2 Array Functions</li> <li>1.5.3 Mathematical Functions</li> <li>1.5.4 Graphics Library (GD Support)</li> <li>1.5.6 Date and Time Functions</li> <li>1.5.7 Misc. Function</li> </ul> </li> <li>1.6 State management Techniques</li> <li>1.7 Object Oriented Features of PHP <ul style="list-style-type: none"> <li>1.7.1 Classes and Objects</li> <li>1.7.2 Use of constructors</li> <li>1.7.3 Serialization</li> <li>1.7.4 Inheritance</li> </ul> </li> </ul> <p><b>Unit 2 : MySQL database server</b></p> <ul style="list-style-type: none"> <li>2.1 Configuring the MySQL Server</li> <li>2.2 MySQL Tables, Displaying MySQL Database ,Adding and removing user access</li> <li>2.3 Database connection and data processing functions</li> </ul> <p><b>Unit 3 : Advance PHP</b></p> <ul style="list-style-type: none"> <li>3.1 Ajax Basics <ul style="list-style-type: none"> <li>3.1.1 HTTP Request and Response Fundamentals</li> <li>3.1.2 The XMLHttpRequest Object XMLHttpRequest Methods</li> <li>3.1.3 XMLHttpRequest Properties</li> <li>3.1.4 Cross-Browser Usage Sending a Request to the Server</li> <li>3.1.5 PHP and Ajax Client-Driven Communication</li> <li>3.1.6 Server-Side Processing Expanding and Contracting Content</li> <li>3.1.7 Form Validation</li> <li>3.1.8 Ajax-Based Database Querying</li> </ul> </li> <li>3.2 XML</li> <li>3.3 Web services</li> </ul>

	<p><b>Unit 4 : MVC</b></p> <ul style="list-style-type: none"> <li>4.1 Introduction to MVC</li> <li>4.2 Introduction to Laravel, Architecture Concepts</li> <li>4.3 Routing</li> <li>4.4 Middleware</li> <li>4.5 Controllers</li> <li>4.6 Request &amp; Response</li> <li>4.7 View</li> <li>4.8 URL generation</li> <li>4.9 Validation</li> <li>4.10 Session &amp; Cookie</li> <li>4.11 Form &amp; File uploading</li> <li>4.12 Error Handling</li> <li>4.13 Security</li> <li>4.14 Database</li> </ul> <p><b>Unit 5 : Advance Concepts of MVC</b></p> <ul style="list-style-type: none"> <li>5.1 Blade Templates</li> <li>5.2 Mail</li> <li>5.3 Authentication</li> <li>5.4 Authorization</li> <li>5.5 Encryption</li> </ul>
Reference Books	<ol style="list-style-type: none"> <li>1. Beginning PHP, Apache, MySQL Web Development - Elizabeth Narmore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Michael K. Glass, Gary Mailer – Wrox Publication</li> <li>2. Professional PHP Programming - Jesus Castagnetto ,Wrox Press Ltd</li> <li>3. Beginning PHP and MySQL: From Novice to Professional - W. Jason Gilmore, Apress</li> <li>4. Php: The Complete Reference - Steven Holzner, Tata Mcgraw Hill Education Private Limited</li> <li>5. AJAX and PHP: Building Responsive Web Applications - Bogdan Brinzarea, CristianDarie packtpub</li> <li>6. Php manual – www. Php.com</li> <li>7. Beginning Laravel Build Websites with Laravel 5.8 - Sanjib Sinha · 2019 - Apress</li> <li>8. Laravel The Ultimate Beginner's Guide to Learn Laravel Step by Step, 2<sup>nd</sup> Edition - Mem Lnc, Rufus Stewart</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 306: Programming Skills VIII

Course Code	306
Course Title	<b>Programming Skills VIII</b>
Credit	2
Teaching per Week	2 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	Learn practically IoT / ML
Course Objective	Learn IoT practically, understand the working of Micro-Controller & Micro-Computer and using various types of sensors and its Programming. OR Implement various algorithms used in Machine learning and introduce students with Programming in ML.
Pre-requisite	C/C++ for IoT OR Python Programming for ML
Course Outcome	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. OR After successful completion, students will be able to work with different types of ML algorithms and ML based application development.
Course Content	Practical based on paper no 301. (IoT/ML) Separate journal to be prepared for this subject 301.
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: 307: Programming Skills IX

Course Code	307
Course Title	<b>Programming Skills IX</b>
Credit	3
Teaching per Week	2 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 303. Separate journal to be prepared for this subject 303.
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: 308: Programming Skills X

Course Code	308
Course Title	<b>Programming Skills X</b>
Credit	2
Teaching per Week	2 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	This course helps students in developing full stack web applications.
Course Objective	Practically learn full stack development
Pre-requisite	HTML, CSS, Front-end Scripting
Course Outcome	After completion of this course, the students will be able to design and develop Full Stack web applications
Course Content	Practical based on paper no 304. (Full Stack Technology) Separate journal to be prepared for this subject 304.
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: 309: Programming Skills XI

Course Code	309
Course Title	<b>Programming Skills XI</b>
Credit	3
Teaching per Week	2 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 305. Separate journal to be prepared for this subject 305.
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 3rd  
Sem.  
(Database  
Group)**

**Course: 301: Internet of Things (IoT)**  
(Elective)

Course Code	301
Course Title	<b>Internet of Things (IoT)</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 - 5. To make student understand IoT 6. To understand the working of Micro-Controller & Micro-Computer 7. To explain various types of sensors 8. To introduce students with Programming in IoT
Pre-requisite	C, C++
Course Outcome	After studying this course, student will be able to understand how Micro-Controller & Micro-Computer works. It will also help them 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	<p><b>Unit 1: Introduction to IoT</b></p> <ul style="list-style-type: none"> <li>1.1 What is IoT</li> <li>1.2 IoT Applications</li> <li>1.3 IoT Privacy and Security <ul style="list-style-type: none"> <li>1.3.1 Identification in Distributed Environment</li> <li>1.3.2 Device Authentication</li> </ul> </li> <li>1.4 IoT Botnet</li> </ul> <p><b>Unit 2: Networking and Communication</b></p> <ul style="list-style-type: none"> <li>2.1 Basics of Wireless Networking <ul style="list-style-type: none"> <li>2.1.1 CSMA/CA</li> </ul> </li> <li>2.2 IoT Network Protocols <ul style="list-style-type: none"> <li>2.2.1 BLE, Zigbee, LoRaWAN, RFID</li> </ul> </li> <li>2.3 IoT Data Protocols <ul style="list-style-type: none"> <li>2.3.1 CoAP, MQTT, XMPP, DDS</li> </ul> </li> </ul> <p><b>Unit 3: Sensors</b></p> <ul style="list-style-type: none"> <li>3.1 Introduction to Sensors</li> <li>3.2 Types of Sensors &amp; their working</li> <li>3.3 Wireless Sensor Network <ul style="list-style-type: none"> <li>3.3.1 Introduction to WSN</li> <li>3.3.2 Applications</li> <li>3.3.3 Characteristics</li> <li>3.3.4 Challenges</li> <li>3.3.5 Components</li> </ul> </li> <li>3.4 Wireless Adhoc Network Vs Wireless Sensor Network</li> </ul> <p><b>Unit 4: Micro-Controller: Arduino, NodeMCU</b></p> <ul style="list-style-type: none"> <li>4.1 Introduction to Microcontrollers</li> <li>4.2 Arduino IDE</li> <li>4.3 Arduino Architecture</li> </ul>

	<p>4.4 Arduino Pin Diagram</p> <p>4.5 Introduction to NodeMCU</p> <p>4.6 NodeMCU Specifications and Applications</p> <p>4.7 NodeMCU ESP8266 Pinout</p> <p><b>Unit 5: IoT App Interaction &amp; Introduction to Raspberry Pi</b></p> <p>5.1 Uploading sensor data to server</p> <p>5.2 Reading sensor data from server</p> <p>5.3 Controlling IoT device and components from Mobile or Web</p> <p>5.4 Introduction to Microcomputers</p> <p>5.5 Raspberry Pi Architecture</p> <p>5.6 Raspberry Pi Pinout</p>
Reference Books	<ol style="list-style-type: none"> <li>1) Getting Started with Internet of Things – By Cuno Pfister, O’Reilly</li> <li>2) Learning Internet of Things – By Peter Waher , Packt Publication</li> <li>3) Internet of Things : A Hands-on Approach – By Arshdip Bahga and Vijay Madiseti</li> <li>4) IoT Governance, Privacy and Security Issues, IERC</li> <li>5) IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Cisco Press</li> <li>6) Fundamentals of IoT Communication Technologies, Springer</li> <li>7) Microcontrollers – Architecture, Programming, Interfacing and system design – By Raj Kamal , Pearson</li> <li>8) Exploring C for Microcontrollers : A hands on approach, Springer</li> <li>9) Arduino for Dummies, Wiley</li> <li>10) Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media</li> <li>11) ESP8266: Get Started With ESP8266 Programming NodeMCU Using Arduino IDE, Createspace Independent Pub</li> <li>12) Internet of Things Projects with ESP32, Packt Publishing Limited</li> <li>13) Microprocessor Architecture, Programming and Applications with the 8085 - By Ramesh Gaonkar , Penram International Publishing</li> <li>14) Raspberry Pi for Dummies , Wiley</li> <li>15) Raspberry Pi User Guide – By Eben Upton and Garath Halfacree, Wiley</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

**Course: 301: Machine Learning**  
(Elective)

Course Code	301
Course Title	<b>Machine Learning (ML)</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	This course is an introduction for students to ML. The course also gives students an idea about various methods and algorithms of Machine Learning and application development of ML.
Course Objective	The objective of the course is – 1. To make student understand ML 2. To understand the various Machine Learning method 3. To explain various algorithms used in Machine learning 4. To introduce students with Programming in ML
Pre-requisite	Basics of Linear Algebra, Statistics and Mathematics, Python Programming
Course Outcome	After studying this, student will be able to understand how ML works. This course will also help students to appreciate the role of ML in industry environment. After successful completion, students will be able to work with different types of ML algorithms and ML based application development.
Course Content	<p><b>Unit 1 : Introduction</b></p> 1.1. Definition of Machine Learning 1.2 Types of Machine Learning : Supervised , Unsupervised and Semi-supervised 1.3 Applications and tools of Machine Learning (Scikit learn library) 1.4 Data Pre-processing, Selecting a model and training a model 1.5 Evaluating a performance of model and improving performance
	<p><b>Unit 2 : Data Wrangling</b></p> 2.1 Definition and goal of Data Wrangling 2.2 Importance of Data Wrangling 2.3 Data Pre-processing and Data Cleaning 2.3.1 Data Cleaning 2.3.2 Data Transformation 2.3.3 Data Reduction 2.3.4 Data Discretization 2.3.5 Feature Selection 2.4 Data Visualization
	<p><b>Unit 3 : Supervised Learning</b></p> 3.1 Supervised Learning : Classification and Regression 3.2 Regression 3.2.1 Simple and Multiple Regression 3.2.2 Linear Regression 3.2.3 Gradient Decent 3.2.4 Logistic Regression 3.3 Classification Algorithms : 3.3.1 K-nearest Neighbour

	<p>3.3.2 Support Vector Machines  3.3.3 Decision Trees  3.3.4 Naïve Bayes Classifier  3.4 Introduction to Support Vector Machine</p> <p><b>Unit 4 : Neural Network</b>  4.1 Introduction to Neural Network  4.2 Architecture of Neural Network  4.3 Feedforward network and Backpropagation with example  4.4 Applications of Neural Network</p> <p><b>Unit 5 : Unsupervised Learning</b>  5.1 Introduction to Unsupervised learning  5.2 Clustering  5.2.1 Selection of Clusters  5.2.2 Algorithms :  5.2.2.1 K – means clustering  5.2.2.2 Hierarchical Clustering  5.3 Association Rule Learning  5.3.1 Algorithms :  5.3.1.1 FP- Growth  5.3.1.2 Apriori Algorithm</p>
Reference Books	<ol style="list-style-type: none"> <li>1. "Machine Learning" by Tom M. Mitchell, McGraw Hill</li> <li>2. "Understanding Machine Learning" by Shai Shalev-Shwartz, Shai Ben-David</li> <li>3. "Machine Learning" by Anuradha Srinivasaraghavan, Vincy Joseph</li> <li>4. "Machine Learning using Python" by U Dinesh Kumar Manaranjan Pradhan</li> <li>5. "Real-World Machine Learning" by Henrik Brink, Joseph Richards, Mark Fetherolf</li> <li>6. "Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili</li> <li>7. "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems" by Aurelien Geron</li> <li>8. "Machine Learning in Action" by Peter Harrington</li> <li>9. "Introduction to Machine Learning with Python : A Guide for Data Scientists" by Andreas C. Muller, Sarah Guido</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 302: Design Patterns

Course Code	302
Course Title	<b>Design Patterns</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	The purpose of the course is to make student understand how Patterns can be implemented in various object oriented programming languages to solve real world problems.
Course Objective	The objective of the course is - <ol style="list-style-type: none"> <li>3. To study various Design Patterns</li> <li>4. How these Patterns can be used to design better systems through Object Oriented Programming Languages</li> </ol>
Pre-requisite	Object Oriented Programming, Software Engineering
Course Outcome	After completion of this course, the student will be capable of implementing various Design Patterns in different Object Oriented Programming languages.
Course Content	<p><b>Unit -1 Creational Patterns</b></p> <ol style="list-style-type: none"> <li>1.1 Singleton Pattern</li> <li>1.2 Prototype Pattern</li> <li>1.3 Builder Pattern</li> <li>1.4 Factory Method Pattern</li> <li>1.5 Abstract Factory Pattern</li> </ol> <p><b>Unit-2 Structural Patterns</b></p> <ol style="list-style-type: none"> <li>2.1 Proxy Pattern</li> <li>2.2 Decorator Pattern</li> <li>2.3 Adapter Pattern</li> <li>2.4 Façade Pattern</li> <li>2.5 Flyweight Pattern</li> <li>2.6 Composite Pattern</li> <li>2.7 Bridge Pattern</li> </ol> <p><b>Unit-3 Behavioural Pattern</b></p> <ol style="list-style-type: none"> <li>3.1 Visitor Pattern</li> <li>3.2 Observer Pattern</li> <li>3.3 Strategy Pattern</li> <li>3.4 Template Method Pattern</li> <li>3.5 Command Pattern</li> <li>3.6 Iterator Pattern</li> <li>3.7 Memento Pattern</li> <li>3.8 State Pattern</li> <li>3.9 Mediator Pattern</li> <li>3.10 Interpreter Pattern</li> </ol> <p><b>Unit-4 Additional Design Patterns</b></p> <ol style="list-style-type: none"> <li>4.1 Simple Factory Pattern</li> <li>4.2 Null Object Pattern</li> <li>4.3 MVC Pattern</li> </ol> <p><b>Unit-5 Pattern Applicability</b></p> <ol style="list-style-type: none"> <li>5.1 Security Patterns Repository</li> <li>5.2 Patterns for Agile Development</li> <li>5.3 Restful Service Patterns</li> <li>5.4 Solution with semaphore</li> </ol>

	<p>5.5 Patterns and Pattern combination in practice</p> <p>5.6 Big Ball of Mud</p> <p><b>Self-Study :</b> Pattern Languages</p>
Reference Books	<p>7. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph, John, Addison Wesley</p> <p>8. Head First Design Patterns, Eric Freeman, O'Reilly</p> <p>9. Design Patterns in C#, Vaskaran Sarcar, Apress</p> <p>10. Design Patterns in Modern C++, Reusable Approaches for Object-Oriented Software Design, Dmitri Nesteruk, Apress</p> <p>11. Modern C++ design: generic Programming and design patterns applied, Alexendrescu, Andrei, Addison-Wesley</p> <p>12. Java Design Patterns: A Hands-on Experience with Real-World Examples, Vaskaran Sarcar, Apress</p>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30 % internal assessment and 70% external assessment

## Course: 303: ERP Using SAP

Course Code	303
Course Title	<b>ERP Using SAP</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2021
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	<p><b>Unit 1: Introduction</b></p> <ol style="list-style-type: none"> <li>1.1 Introduction to ERP</li> <li>1.2 Introduction to SAP</li> <li>1.3 Example: How SAP works in an Organization</li> </ol> <p><b>Unit 2: Architecture of SAP Application Server</b></p> <ol style="list-style-type: none"> <li>2.1 3-Tier Architecture</li> <li>2.2 Application Servers</li> <li>2.3 Work processes and its Type</li> </ol> <p><b>Unit 3: Data Dictionary &amp; Data Structures in ABAP</b></p> <ol style="list-style-type: none"> <li>3.1 Introduction to Data dictionary</li> <li>3.2 Different Types of Data structures</li> <li>3.3 Internal Tables and its operation</li> </ol> <p><b>Unit 4: Modularization Techniques</b></p> <ol style="list-style-type: none"> <li>4.1 Include Programs</li> <li>4.2 Subroutines</li> <li>4.3 Function Module.</li> <li>4.4 Types of Function Module(Simple, RFC enabled, BAPI)</li> </ol> <p><b>Unit 5: List Report, ALV Report</b></p> <ol style="list-style-type: none"> <li>5.1 Simple List Report</li> <li>5.2 Interactive List Report</li> <li>5.3 Events in List Reports</li> <li>5.4 Field catalog generation in ALV</li> <li>5.5 Operation on ALV(Sorting, Filtering, Totals, Subtotals, Download, Hide Columns)</li> </ol> <p><b>Unit 6: Module pool programming / Screen Programming</b></p> <ol style="list-style-type: none"> <li>6.1 Screen Elements(Simple &amp; Complex)</li> <li>6.2 Screen Events(PBO/PAI)</li> <li>6.3 Transactions</li> </ol> <p><b>Unit 7: Selection-Screen programming</b></p> <ol style="list-style-type: none"> <li>7.1 Defining Selection Screen.</li> <li>7.2 User Actions on Selection Screen.</li> <li>7.3 Events of Selection Screen</li> </ol>

	<p><b>Unit 8: Smartform/Sapscript</b></p> <p>8.1 Form printing with smartform</p> <p>8.2 Form printing with Sapscript</p> <p><b>Unit 9: BDC &amp; LSMW</b></p> <p>9.1 Data upload through BDC</p> <p>9.2 Data upload through LSMW</p> <p><b>Unit 10: Enhancement(Exits &amp; BADI)</b></p> <p>10.1 What is Enhancement</p> <p>10.2 User-Exits</p> <p>10.3 BADI(Business Add-in)</p>
Reference Books	<ol style="list-style-type: none"> <li>1. ABAP Cookbook by James Wood</li> <li>2. BC - ABAP Programming from SAP-AG</li> <li>3. Teach Yourself ABAP/4 in 21 Days by Ken Greenwood, SAMS</li> <li>4. SAP Smart Forms by Christoph Wachter, Werner Hertleif</li> <li>5. SAPscript by Michaelson Buchanan</li> <li>6. Developing Sap's R/3 Application with Abap/4</li> <li>7. Data Migration Made Easy - R/3 Simplications Group, SAP Labs</li> <li>8. ABAP Development for SAP NetWeaver BW: Exits, BAdIs, and Enhancements by Dirk Herzog</li> <li>9. Next Generation ABAP Development (2nd Edition) by Rich Heilman and Thomas Jung</li> </ol>
Teaching Methodology	Discussion, Independent Study, Seminars and Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 303: NoSQL Databases

Course Code	303
Course Title	<b>NoSQL Databases</b>
Credit	4
Teaching per Week	4
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2021
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	<p><b>Unit 1: Introduction</b></p> <ul style="list-style-type: none"> <li>1.1 History</li> <li>1.2 Concepts and Characteristics of NoSQL databases</li> <li>1.3 Primary benefits of NoSQL databases</li> </ul> <p><b>Unit 2: MongoDB</b></p> <ul style="list-style-type: none"> <li>2.1 SQL/NoSQL landscape</li> <li>2.2 Document Vs. Other types of Storage</li> <li>2.3 MongoDB feature set</li> <li>2.4 Introduction to BSON and JSON</li> <li>2.5 MongoDB Architecture</li> <li>2.6 Documents and Collections <ul style="list-style-type: none"> <li>2.6.1 Creating Documents</li> <li>2.6.2 Managing Documents in collections</li> <li>2.6.3 Iterating over Documents</li> </ul> </li> <li>2.7 Queries <ul style="list-style-type: none"> <li>2.7.1 Simple Queries</li> <li>2.7.2 Complex Queries <ul style="list-style-type: none"> <li>2.7.2.1 Existential field values</li> <li>2.7.2.2 Aggregations and groups</li> <li>2.7.2.3 Aggregations and groups in hierarchical data</li> </ul> </li> </ul> </li> <li>2.8 Updates and Deletes</li> <li>2.9 Updates and Arrays</li> <li>2.10 Indexing</li> <li>2.11 MongoDB RESTful API</li> <li>2.12 MongoDB Security</li> <li>2.13 MongoDB Replication and Sharing</li> <li>2.14 Introduction to MapReduce</li> </ul> <p><b>Unit 3: Cassandra</b></p> <ul style="list-style-type: none"> <li>3.1 Cassandra Architecture <ul style="list-style-type: none"> <li>3.1.1 Cassandra P2P Architecture</li> <li>3.1.2 Clustering Structures- Nodes</li> <li>3.1.3 Rings</li> <li>3.1.4 Virtual Nodes</li> <li>3.1.5 Consistency &amp; Hashing</li> <li>3.1.6 Gossip Protocol</li> <li>3.1.7 Data Replication</li> <li>3.1.8 Replication Factors &amp; Indexes</li> <li>3.1.9 Tunable Consistency</li> <li>3.1.10 High &amp; Rapid Scalability Memtables, SStables &amp; Commitlogs</li> </ul> </li> </ul>

	<p>3.1.11 Repairs</p> <p>3.1.12 Tombstones</p> <p>3.1.13 Repairs</p> <p>3.1.14 Replication Factors</p> <p>3.1.15 Compaction and Anti-Entropy</p> <p>3.1.16 Bloom Filters</p> <p>3.2 Data Modelling in Cassandra</p> <p>3.3 Cassandra Administration</p> <p>3.4 CQL3</p> <p>3.5 Integration with Hadoop</p>
Reference Books	<ol style="list-style-type: none"> <li>1. Chodorow, K. (2013). MongoDB: The Definitive Guide (2nd ed.). Upper Saddle River, NJ: Pearson Education, Inc. ISBN-13: 978-1449344689 ISBN-10: 1449344682.</li> <li>2. Shashank Tiwari, Professional NoSQL, Sierra Nevada Books, ISBN-13: 978-0470942246</li> <li>3. Amol Nayak, Instant MongoDB, Packt Publishing Limited, 2013, ISBN-13: 978-1782169703</li> <li>4. Kristina Chodorow, MongoDB Definitive Guide 2e, O'Reilly, 2013, ISBN-13: 978-1449344689</li> <li>5. Eben Hewitt, Cassandra Definitive Guide, O'Reilly, 2010, ISBN:ISBN 10:1-4493-9041-2</li> </ol>
Teaching Methodology	Classroom, seminar and assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 304: Advanced Database Administration

Course Code	304
Course Title	<b>Advanced Database Administration</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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	<p><b>Unit 1. Oracle10g Instance creation and management</b></p> <ol style="list-style-type: none"> <li>1.1 Oracle Instance</li> <li>1.2 Installing Oracle</li> <li>1.3 Oracle Optimal Flexible Architecture (OFA)</li> <li>1.4 Locating initialization, listener.ora &amp; sqlnet.ora files</li> <li>1.5 Finding the alert log</li> <li>1.6 Common environment variables</li> <li>1.7 Structures in an Oracle Instance</li> <li>1.8 Oracle Memory Structures, SGA and PGA</li> <li>1.9 Oracle Processes and their purposes</li> <li>1.10 Startup, nomount, mount and open database commands</li> </ol> <p><b>Unit 2. Oracle10g Database Architecture</b></p> <ol style="list-style-type: none"> <li>2.1 Oracle10g management framework</li> <li>2.1 Using the Database Creation Assistant (DBA)</li> <li>2.3 Creating and dropping a database</li> <li>2.4 Tablespaces</li> <li>2.5 Tables and Indexes</li> <li>2.6 Clusters</li> <li>2.7 Partitioning of Tables and Indexes</li> <li>2.8 Gathering and applying patches</li> </ol> <p><b>Unit 3. Concurrency Management</b></p> <ol style="list-style-type: none"> <li>3.1 Transactions, serialization, locks and latches</li> <li>3.2 Lock modes</li> <li>3.3 Detecting and resolving lock conflicts</li> <li>3.4 Managing deadlocks</li> </ol> <p><b>Unit 4. Interfacing with Oracle</b></p> <ol style="list-style-type: none"> <li>4.1 Oracle transaction management</li> <li>4.2 Using SQL*Plus and iSQL*Plus</li> <li>4.3 Using embedded Oracle with Pro*C &amp; Java</li> <li>4.4 PL/SQL &amp; Triggers</li> <li>4.5 Pining PL/SQL packages &amp; compiling PL/SQL</li> <li>4.6 System-level triggers – startup trigger, logon trigger, PL/SQL error trigger</li> </ol> <p><b>Unit 5. Oracle*Net</b></p> <ol style="list-style-type: none"> <li>5.1 Basic Network structure</li> <li>5.2 Oracle*Net Files</li> <li>5.3 Multi-threaded server</li> <li>5.4 Create additional listeners</li> <li>5.5 Create Oracle Net service aliases</li> </ol>

- 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 v\$db\_cache\_advice, v\$shared 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**

	<p>12.1 Oracle backup &amp; recovery planning</p> <p>12.2 Parallel instance recovery</p> <p>12.3 Basics of checkpoints, redo log files, and archived log files</p> <p>12.4 Using ARCHIVELOG mode</p> <p>12.5 Creating consistent Oracle backups</p> <p>12.6 Online hot backups</p> <p>12.7 Incremental Oracle backups</p> <p>12.8 Automating database backups with dbms_scheduler</p> <p>12.9 Monitor the flash recovery area</p> <p>12.10 Recovering from loss of a Control file</p> <p>12.11 Recovering from loss of a Redo log file</p> <p>12.12 Recovering from loss of a system-critical data file</p> <p>12.13 Recovering from loss of a non system-critical data file</p>
Reference Books	<ol style="list-style-type: none"> <li>1. Essentials : Oracle Database 10g by Rick Greenwald, Robert Stackowiak, Jonathan Stern, O'Reilly</li> <li>2. Oracle High Performance Tuning for 9i and 10g by Gavin Powell, Digital Press</li> <li>3. Oracle Database 10g, DBA Handbook by Loney, Kevin, Bryla, Bob, Oracle Press</li> <li>4. Oracle Database 10g - The Complete Reference by Loney, Kevin, Oracle Press</li> <li>5. Oracle Database 10g: A Beginner's Guide by Micheal Abbey, Ian Abramson Osborne, Oracle Press Series</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 305: Data Warehousing & Data Mining

Course Code	305
Course Title	<b>Data Warehousing &amp; Data Mining</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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	<p><b>Unit 1: Data warehouse: Introduction</b></p> <ol style="list-style-type: none"> <li>1.1 Data Warehouse characteristics</li> <li>1.2 Data Marts</li> <li>1.3 OLTP and OLAP systems</li> <li>1.4 Star, Snowflakes, and Fact Constellations Schemas for Multi-dimensional Databases</li> <li>1.5 OLAP Operations in the Multidimensional data model</li> <li>1.6 Type of OLAP servers</li> </ol> <p><b>Unit 2: Developing Data Warehouse</b></p> <ol style="list-style-type: none"> <li>2.1 Building a Data Warehouse</li> <li>2.2 Three-Tier Data Warehouse Architecture</li> <li>2.3 Metadata Repository</li> </ol> <p><b>Unit 3: Data Pre-processing</b></p> <ol style="list-style-type: none"> <li>3.1 Descriptive Data Summarization: central tendency, dispersion of data</li> <li>3.2 Data Cleaning : missing values, noisy data</li> <li>3.3 Data Integration &amp; Transformation</li> <li>3.4 Data Reduction: Attribute selection</li> <li>3.5 Data Discretization &amp; Concept Hierarchy Generation</li> </ol> <p><b>Unit 4: Data Mining: Introduction</b></p> <ol style="list-style-type: none"> <li>4.1 Knowledge discovery and Data Mining.</li> <li>4.2 Basic Introduction to Data Mining Functionalities:             <ol style="list-style-type: none"> <li>4.2.1 Concept/Class Description Characterization &amp; Discrimination</li> <li>4.2.2 Mining Frequent Patterns, Associations, and Correlations</li> <li>4.2.3 Classification &amp; Prediction</li> <li>4.3.4 Cluster Analysis</li> <li>4.2.5 Outlier Analysis</li> <li>4.2.6 Evolution analysis</li> </ol> </li> </ol> <p><b>Unit 5: Mining Frequent Patterns, Associations, and Correlations</b></p> <ol style="list-style-type: none"> <li>5.1 Basic concepts: Frequent Itemsets &amp; Closed Itemsets, Association Rules</li> <li>5.2 The Apriory algorithm: Finding Frequent Itemsets Using Candidate Generation</li> <li>5.3 FP-growth: Finding Frequent Itemsets without Candidate Generation</li> <li>5.4 Generating Association Rules from Frequent Itemsets</li> <li>5.5 Introduction to multilevel and multidimensional Association rules</li> </ol> <p><b>Unit 6: Classification &amp; Prediction</b></p>

	<p>6.1 Introduction to Classification &amp; Prediction?</p> <p>6.2 Prediction: Linear Regression, Nonlinear Regression</p> <p>6.3 Decision Tree Algorithm</p> <p>6.3.1 Decision Tree Induction</p> <p>6.3.2 Attribute Selection Measures- Information Gain and Gain Ratio</p> <p>6.3.3 Tree Pruning</p> <p>6.4 Bayesian Classification</p> <p>6.4.1 Bayes' Theorem</p> <p>6.4.2 Naïve Bayesian Classification</p> <p>6.5 Accuracy and Error Measures for classification</p> <p><b>Unit 7: Cluster Analysis</b></p> <p>7.1 Classification vs. clustering</p> <p>7.2 What is Partitioning &amp; Hierarchical Clustering Methods</p> <p>7.3 Classical Partitioning Methods: k-Means</p> <p><b>Unit 8: Application and Trends in Data Mining</b></p>
Reference Books	<ol style="list-style-type: none"> <li>1. Data Mining: Concepts &amp; Techniques by Han &amp; Kamber , Morgan Kaufmann Publishers</li> <li>2. Introduction to Data Mining with Case Studies by G. K. Gupta, PHI</li> <li>3. Data Mining Introductory and Advanced Topics by Dunha, Pearson</li> <li>4. Data Warehouse Toolkit by R. Kinball, John Wiley &amp; Sons</li> <li>5. Data Warehouses and OLAP: Concepts, Architectures, and Solutions by Robert Wrembel, Christian Koncilia I, GI</li> <li>6. Data Mining Techniques: For Marketing, Sales, and Customer Relationship Management by Gordon S. Linoff, Michael J. A. Berry, Wiley</li> <li>7. Data Preparation for Data Mining by Dorian Pyle, Morgan Kaufmann Publishers</li> <li>8. Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals by Paulraj Ponniah, Wiley</li> <li>9. Data Warehousing: Concepts, Techniques, Products and Applications by C.S.R. Prabhu, PHI Learning</li> <li>10. Advanced Data Mining Techniques by David Louis Olson, Dursun Delen, Springer</li> </ol>
Teaching Methodology	Class work, Discussion, Self-study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 305: Big Data

Course Code	305
Course Title	<b>Big Data</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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	<p><b>Unit 1: Introduction</b></p> <ul style="list-style-type: none"> <li>1.1 Evolution of Big Data</li> <li>1.2 Structuring Big Data</li> <li>1.3 Elements of Big Data(V's)</li> <li>1.4 Big Data Analytics</li> <li>1.5 Commercial use of Big Data</li> </ul> <p><b>Unit 2: Big Data Technology</b></p> <ul style="list-style-type: none"> <li>2.1 Distributed and Parallel Computing</li> <li>2.2 Introducing Hadoop</li> <li>2.3 HDFS and MapReduce</li> <li>2.4 Cloud Computing and Big Data</li> <li>2.5 In-Memory Computing</li> </ul> <p><b>Unit 3: Hadoop</b></p> <ul style="list-style-type: none"> <li>3.1 HDFS Architecture</li> <li>3.2 Blocks</li> <li>3.3 Name Nodes and Data Nodes</li> <li>3.4 Using HDFS Files</li> <li>3.5 Hadoop Specific File System Types</li> <li>3.6 HDFS Commands</li> <li>3.7 org.apache.hadoop.io package</li> <li>3.8 MapReduce Architecture</li> <li>3.9 Hadoop YARN</li> <li>3.10 HBase</li> <li>3.11 Combining HBase</li> <li>3.12 Hive</li> <li>3.13 Pig and Pig Latin</li> <li>3.14 Sqoop</li> </ul> <p><b>Unit 4: Technology Foundations</b></p> <ul style="list-style-type: none"> <li>4.1 Big Data Stack</li> <li>4.2 Virtualization and Big Data</li> </ul> <p><b>Unit 5: Storing Data in Databases and Processing of Data</b></p> <ul style="list-style-type: none"> <li>5.1 RDBMS and Big Data <ul style="list-style-type: none"> <li>5.1.1 CAP Theorem</li> </ul> </li> <li>5.3 NoSQL Databases</li> <li>5.4 Polygot Persistence</li> <li>5.5 Integrating Big Data with traditional Data Warehouses</li> <li>5.6 Big Data Analytics</li> </ul>

	<p>5.7 Processing Data with MapReduce</p> <p>5.8 Customizing MapReduce Execution and implementing MapReduce Program</p> <p>5.9 Testing and Debugging MapReduce Applications</p> <p>5.10 Analytical Approaches and Tools to Analyze Data</p>
Reference Books	<ol style="list-style-type: none"> <li>1. D T Editorial services, Big Data Black book, Dreamtech Press, ISBN 978-93-5119-931</li> <li>2. Alex Holmes, Hadoop in Practice, Manning Publication company, 2014, ISBN 1617292222, 9781617292224</li> <li>3. Kuan-Ching, Li Hai Jiang, Laurence T. Yang Alfredo Cuzzocrea, Big Data : Algorithms, Analytics and Applications. CRC Press</li> <li>4. Hu, Wen Chen, Big Data Management, Technologies and Applications, IGI Global</li> <li>5. Tom White, Hadoop The Definitive Guide, o'Reilly</li> </ol>
Teaching Methodology	Class work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 306: Programming Skills VIII

Course Code	306
Course Title	<b>Programming Skills VIII</b>
Credit	2
Teaching per Week	2 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	Learn practically IoT / ML
Course Objective	Learn IoT practically, understand the working of Micro-Controller & Micro-Computer and using various types of sensors and its Programming. OR Implement various algorithms used in Machine learning and introduce students with Programming in ML.
Pre-requisite	C/C++ for IoT OR Python Programming for ML
Course Outcome	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. OR After successful completion, students will be able to work with different types of ML algorithms and ML based application development.
Course Content	Practical based on paper no 301. (IoT/ML) Separate journal to be prepared for this subject 301.
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: 307: Programming Skills IX

Course Code	307
Course Title	<b>Programming Skills IX</b>
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 303. Separate journal to be prepared for this subject 303.
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: 308: Programming Skills X

Course Code	308
Course Title	<b>Programming Skills X</b>
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 304. Separate journal to be prepared for this subject 304.
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: 309: Programming Skills XI

Course Code	309
Course Title	<b>Programming Skills XI</b>
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 305. Separate journal to be prepared for this subject 305.
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 3rd  
Sem.  
(Network  
Group)**

**Course: 301: Internet of Things (IoT)**  
(Elective)

Course Code	301
Course Title	<b>Internet of Things (IoT)</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 - 9. To make student understand IoT 10. To understand the working of Micro-Controller & Micro-Computer 11. To explain various types of sensors 12. To introduce students with Programming in IoT
Pre-requisite	C, C++
Course Outcome	After studying this course, student will be able to understand how Micro-Controller & Micro-Computer works. It will also help them 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	<p><b>Unit 1: Introduction to IoT</b></p> <ul style="list-style-type: none"> <li>1.1 What is IoT</li> <li>1.2 IoT Applications</li> <li>1.3 IoT Privacy and Security <ul style="list-style-type: none"> <li>1.3.1 Identification in Distributed Environment</li> <li>1.3.2 Device Authentication</li> </ul> </li> <li>1.4 IoT Botnet</li> </ul> <p><b>Unit 2: Networking and Communication</b></p> <ul style="list-style-type: none"> <li>2.1 Basics of Wireless Networking <ul style="list-style-type: none"> <li>2.1.1 CSMA/CA</li> </ul> </li> <li>2.2 IoT Network Protocols <ul style="list-style-type: none"> <li>2.2.1 BLE, Zigbee, LoRaWAN, RFID</li> </ul> </li> <li>2.3 IoT Data Protocols <ul style="list-style-type: none"> <li>2.3.1 CoAP, MQTT, XMPP, DDS</li> </ul> </li> </ul> <p><b>Unit 3: Sensors</b></p> <ul style="list-style-type: none"> <li>3.1 Introduction to Sensors</li> <li>3.2 Types of Sensors &amp; their working</li> <li>3.3 Wireless Sensor Network <ul style="list-style-type: none"> <li>3.3.1 Introduction to WSN</li> <li>3.3.2 Applications</li> <li>3.3.3 Characteristics</li> <li>3.3.4 Challenges</li> <li>3.3.5 Components</li> </ul> </li> <li>3.4 Wireless Adhoc Network Vs Wireless Sensor Network</li> </ul> <p><b>Unit 4: Micro-Controller: Arduino, NodeMCU</b></p> <ul style="list-style-type: none"> <li>4.1 Introduction to Microcontrollers</li> <li>4.2 Arduino IDE</li> <li>4.3 Arduino Architecture</li> </ul>

	<p>4.4 Arduino Pin Diagram</p> <p>4.5 Introduction to NodeMCU</p> <p>4.6 NodeMCU Specifications and Applications</p> <p>4.7 NodeMCU ESP8266 Pinout</p> <p><b>Unit 5: IoT App Interaction &amp; Introduction to Raspberry Pi</b></p> <p>5.1 Uploading sensor data to server</p> <p>5.2 Reading sensor data from server</p> <p>5.3 Controlling IoT device and components from Mobile or Web</p> <p>5.4 Introduction to Microcomputers</p> <p>5.5 Raspberry Pi Architecture</p> <p>5.6 Raspberry Pi Pinout</p>
Reference Books	<ol style="list-style-type: none"> <li>1) Getting Started with Internet of Things – By Cuno Pfister, O’Reilly</li> <li>2) Learning Internet of Things – By Peter Waher , Packt Publication</li> <li>3) Internet of Things : A Hands-on Approach – By Arshdip Bahga and Vijay Madiseti</li> <li>4) IoT Governance, Privacy and Security Issues, IERC</li> <li>5) IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Cisco Press</li> <li>6) Fundamentals of IoT Communication Technologies, Springer</li> <li>7) Microcontrollers – Architecture, Programming, Interfacing and system design – By Raj Kamal , Pearson</li> <li>8) Exploring C for Microcontrollers : A hands on approach, Springer</li> <li>9) Arduino for Dummies, Wiley</li> <li>10) Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media</li> <li>11) ESP8266: Get Started With ESP8266 Programming NodeMCU Using Arduino IDE, Createspace Independent Pub</li> <li>12) Internet of Things Projects with ESP32, Packt Publishing Limited</li> <li>13) Microprocessor Architecture, Programming and Applications with the 8085 - By Ramesh Gaonkar , Penram International Publishing</li> <li>14) Raspberry Pi for Dummies , Wiley</li> <li>15) Raspberry Pi User Guide – By Eben Upton and Garath Halfacree, Wiley</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

**Course: 301: Machine Learning**  
(Elective)

Course Code	301
Course Title	<b>Machine Learning (ML)</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	This course is an introduction for students to ML. The course also gives students an idea about various methods and algorithms of Machine Learning and application development of ML.
Course Objective	The objective of the course is – 1. To make student understand ML 2. To understand the various Machine Learning method 3. To explain various algorithms used in Machine learning 4. To introduce students with Programming in ML
Pre-requisite	Basics of Linear Algebra, Statistics and Mathematics, Python Programming
Course Outcome	After studying this, student will be able to understand how ML works. This course will also help students to appreciate the role of ML in industry environment. After successful completion, students will be able to work with different types of ML algorithms and ML based application development.
Course Content	<p><b>Unit 1 : Introduction</b></p> 1.1. Definition of Machine Learning 1.2 Types of Machine Learning : Supervised , Unsupervised and Semi-supervised 1.3 Applications and tools of Machine Learning (Scikit learn library) 1.4 Data Pre-processing, Selecting a model and training a model 1.5 Evaluating a performance of model and improving performance
	<p><b>Unit 2 : Data Wrangling</b></p> 2.1 Definition and goal of Data Wrangling 2.2 Importance of Data Wrangling 2.3 Data Pre-processing and Data Cleaning 2.3.1 Data Cleaning 2.3.2 Data Transformation 2.3.3 Data Reduction 2.3.4 Data Discretization 2.3.5 Feature Selection 2.4 Data Visualization
	<p><b>Unit 3 : Supervised Learning</b></p> 3.1 Supervised Learning : Classification and Regression 3.2 Regression 3.2.1 Simple and Multiple Regression 3.2.2 Linear Regression 3.2.3 Gradient Decent 3.2.4 Logistic Regression 3.3 Classification Algorithms : 3.3.1 K-nearest Neighbour

	<p>3.3.2 Support Vector Machines  3.3.3 Decision Trees  3.3.4 Naïve Bayes Classifier  3.4 Introduction to Support Vector Machine</p> <p><b>Unit 4 : Neural Network</b>  4.1 Introduction to Neural Network  4.2 Architecture of Neural Network  4.3 Feedforward network and Backpropagation with example  4.4 Applications of Neural Network</p> <p><b>Unit 5 : Unsupervised Learning</b>  5.1 Introduction to Unsupervised learning  5.2 Clustering  5.2.1 Selection of Clusters  5.2.2 Algorithms :  5.2.2.1 K – means clustering  5.2.2.2 Hierarchical Clustering  5.3 Association Rule Learning  5.3.1 Algorithms :  5.3.1.1 FP- Growth  5.3.1.2 Apriori Algorithm</p>
Reference Books	<ol style="list-style-type: none"> <li>1. “Machine Learning” by Tom M. Mitchell, McGraw Hill</li> <li>2. “Understanding Machine Learning” by Shai Shalev-Shwartz, Shai Ben-David</li> <li>3. “Machine Learning” by Anuradha Srinivasaraghavan, Vincy Joseph</li> <li>4. “Machine Learning using Python” by U Dinesh Kumar Manaranjan Pradhan</li> <li>5. “Real-World Machine Learning” by Henrik Brink, Joseph Richards, Mark Fetherolf</li> <li>6. “Python Machine Learning” by Sebastian Raschka and Vahid Mirjalili</li> <li>7. “Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems” by Aurelien Geron</li> <li>8. “Machine Learning in Action” by Peter Harrington</li> <li>9. “Introduction to Machine Learning with Python : A Guide for Data Scientists” by Andreas C. Muller, Sarah Guido</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 302: Design Patterns

Course Code	302
Course Title	<b>Design Patterns</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	The purpose of the course is to make student understand how Patterns can be implemented in various object oriented programming languages to solve real world problems.
Course Objective	The objective of the course is - <ol style="list-style-type: none"> <li>5. To study various Design Patterns</li> <li>6. How these Patterns can be used to design better systems through Object Oriented Programming Languages</li> </ol>
Pre-requisite	Object Oriented Programming, Software Engineering
Course Outcome	After completion of this course, the student will be capable of implementing various Design Patterns in different Object Oriented Programming languages.
Course Content	<p><b>Unit -1 Creational Patterns</b></p> <ol style="list-style-type: none"> <li>1.1 Singleton Pattern</li> <li>1.2 Prototype Pattern</li> <li>1.3 Builder Pattern</li> <li>1.4 Factory Method Pattern</li> <li>1.5 Abstract Factory Pattern</li> </ol> <p><b>Unit-2 Structural Patterns</b></p> <ol style="list-style-type: none"> <li>2.1 Proxy Pattern</li> <li>2.2 Decorator Pattern</li> <li>2.3 Adapter Pattern</li> <li>2.4 Façade Pattern</li> <li>2.5 Flyweight Pattern</li> <li>2.6 Composite Pattern</li> <li>2.7 Bridge Pattern</li> </ol> <p><b>Unit-3 Behavioural Pattern</b></p> <ol style="list-style-type: none"> <li>3.1 Visitor Pattern</li> <li>3.2 Observer Pattern</li> <li>3.3 Strategy Pattern</li> <li>3.4 Template Method Pattern</li> <li>3.5 Command Pattern</li> <li>3.6 Iterator Pattern</li> <li>3.7 Memento Pattern</li> <li>3.8 State Pattern</li> <li>3.9 Mediator Pattern</li> <li>3.10 Interpreter Pattern</li> </ol> <p><b>Unit-4 Additional Design Patterns</b></p> <ol style="list-style-type: none"> <li>4.1 Simple Factory Pattern</li> <li>4.2 Null Object Pattern</li> <li>4.3 MVC Pattern</li> </ol> <p><b>Unit-5 Pattern Applicability</b></p> <ol style="list-style-type: none"> <li>5.1 Security Patterns Repository</li> <li>5.2 Patterns for Agile Development</li> <li>5.3 Restful Service Patterns</li> <li>5.4 Solution with semaphore</li> </ol>

	<p>5.5 Patterns and Pattern combination in practice  5.6 Big Ball of Mud</p> <p><b>Self-Study :</b>  Pattern Languages</p>
Reference Books	<p>13. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph, John, Addison Wesley</p> <p>14. Head First Design Patterns, Eric Freeman, O'Reilly</p> <p>15. Design Patterns in C#, Vaskaran Sarcar, Apress</p> <p>16. Design Patterns in Modern C++, Reusable Approaches for Object-Oriented Software Design, Dmitri Nesteruk, Apress</p> <p>17. Modern C++ design: generic Programming and design patterns applied, Alexandrescu, Andrei, Addison-Wesley</p> <p>18. Java Design Patterns: A Hands-on Experience with Real-World Examples, Vaskaran Sarcar, Apress</p>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30 % internal assessment and 70% external assessment

## Course: 303: Network Essentials and its Security

Course Code	303
Course Title	<b>Network Essentials and its Security</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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	<p><b>Unit 1: Network Essentials</b></p> <ul style="list-style-type: none"> <li>1.1 Repeaters &amp; Bridges <ul style="list-style-type: none"> <li>1.1.1 LAN Expansion</li> <li>1.1.2 Repeaters</li> <li>1.1.3 Bridges</li> <li>1.1.4 How Bridges Work</li> <li>1.1.5 Creating the routing table</li> <li>1.1.6 Segmenting Network Traffic</li> <li>1.1.7 Remote Bridges</li> <li>1.1.8 Differentiating between bridges and repeaters</li> </ul> </li> <li>1.2 Routers &amp; Gateways <ul style="list-style-type: none"> <li>1.2.1 Routers</li> <li>1.2.2 How routers work</li> <li>1.2.3 Routing benefits</li> <li>1.2.4 Routing protocols</li> <li>1.2.5 Routing V/S Bridging</li> <li>1.2.6 B Routers</li> <li>1.2.7 Gateways</li> <li>1.2.8 How Gateways work</li> </ul> </li> <li>1.3 Network Administration <ul style="list-style-type: none"> <li>1.3.1 Bottlenecks</li> <li>1.3.2 Simple Network Management Protocol</li> <li>1.3.3 Data Protection</li> <li>1.3.4 Backup Methods</li> <li>1.3.5 Testing and Storage</li> <li>1.3.6 Implementing a Backup System</li> <li>1.3.7 Uninterruptible Power Suppliers</li> <li>1.3.8 How Gateways work</li> <li>1.3.9 Implementing Fault Tolerant Systems</li> <li>1.3.10 RAID</li> <li>1.3.11 Sector Sparing</li> </ul> </li> <li>1.4 Advance WAN Transmission <ul style="list-style-type: none"> <li>1.4.1 Overview</li> <li>1.4.2 Multiplexing, Packet and Circuit Switching Networks</li> <li>1.4.3 X.25</li> <li>1.4.4 Asynchronous Transfer Mode (ATM)</li> <li>1.4.5 ISDN</li> <li>1.4.6 SONET</li> <li>1.4.7 SMDS</li> </ul> </li> </ul> <p><b>Unit 2: Introduction to Network Security</b></p> <p><b>Unit 3: Cryptography Techniques</b></p> <ul style="list-style-type: none"> <li>3.1 Classical Cryptography</li> </ul>

	<p>3.2 Conventional Cryptography  3.2.1 DES</p> <p>3.3 Public – key Cryptography  3.3.1 RSA</p> <p>3.4 Digital Signatures  3.4.1 DSA</p> <p><b>Unit 4: Security Services</b>  12.1 Message Integrity  12.2 Confidentiality and Authentication  12.3 Certification and Key Management  4.3.1 PKI</p> <p><b>Unit 5: Network Security Applications</b>  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</p> <p><b>Unit 6: Access Control in Computer Networks</b>  6.1 Authentication Protocols and Services  6.1.1 Kerberos and X.309  6.2 Firewalls  6.3 Virtual Private Networks (VPNs)</p> <p><b>Unit 7: System Security</b>  7.1 Intrusion detection  7.2 Viruses</p> <p><b>Unit 8: Mobile System &amp; E-Commerce Securities</b>  8.1 3G Security  8.2 E-Payment Systems  8.3 Fair Data Exchange</p>
Reference Books	<ol style="list-style-type: none"> <li>1) Cryptography and Network Security, 2/e, ISBN: 0-13-869017-0 - W. Stallings - Pearson Education, 1999</li> <li>2) Network Security Essentials: Applications and Standards, 1/e, ISBN: 0-13-016093-8 - W. Stallings - Pearson Education, 2000</li> <li>3) SSL and TLS: designing and building secure systems, ISBN: 0-201-61598-3 - E. Rescorla - Addison-Wesley, 2001</li> <li>4) Implementing Secure Intranets and Extranets, ISBN: 0-89006-447-4 - K M Phaltankar - Artech House Publishers, 2000</li> <li>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</li> <li>6) Security in Computing, ISBN: 0-13-185794-0, 2/e - C. P. Pfleeger - Prentice Hall, 1997</li> <li>7) Building Internet Firewalls, 2/e, ISBN: 1-56592-871-7 - E. D. Zwicky, et al - O'Reilly, 2000</li> <li>8) CDMA Cellular Mobile Communications &amp; Network Security, ISBN: 0-13-598418-1 - M. Y. Rhee, - Prentice Hall, 1998</li> <li>9) Journal of Computer Security</li> <li>10) ACM Transactions on Information and System Security</li> <li>11) ACM Conference on Computer and Communications Security</li> <li>12) IEEE Symposium on Security and Privacy</li> </ol>

	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: 304: Network Administration

Course Code	304
Course Title	<b>Network Administration</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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	<p><b>Unit 1: Networking and TCP/IP on Linux</b></p> <ul style="list-style-type: none"> <li>a. Fundamentals of Linux Networking</li> <li>b. Fundamentals of TCP/IP on the Linux Operating System</li> <li>c. Advanced Linux TCP/IP Concepts</li> <li>d. Introduction to Dial-up Technologies</li> </ul> <p><b>Unit 2: Dynamic Host Configuration Protocol</b></p> <ul style="list-style-type: none"> <li>2.1 Introduction to BOOTP and DHCP</li> <li>2.2 Installing and Examining a Linux DHCP server</li> <li>2.3 Examining Additional DHCP Options and Configurations</li> </ul> <p><b>Unit 3: Domain Name System</b></p> <ul style="list-style-type: none"> <li>3.1 Introduction to the Domain Name System</li> <li>3.2 Installing and Configuring DNS</li> </ul> <p><b>Unit 4: The Network File System</b></p> <ul style="list-style-type: none"> <li>4.1 Introduction to the Network File System</li> <li>4.2 Configuring NFS</li> </ul> <p><b>Unit 5: Linux Remote Administration</b></p> <ul style="list-style-type: none"> <li>5.1 Introduction to Remote Administration</li> <li>5.2 The Telnet Protocol</li> <li>5.3 The open secure Shell protocol</li> </ul> <p><b>Unit 6: The Cron Daemon</b></p> <ul style="list-style-type: none"> <li>6.1 Introduction to Automation</li> <li>6.2 Configuring the Cron Daemon</li> </ul> <p><b>Unit 7: Samba</b></p> <ul style="list-style-type: none"> <li>7.1 Introduction to Samba</li> <li>7.2 Cross-Platform Connectivity</li> <li>7.3 Installing and Configuring Samba</li> </ul> <p><b>Unit 8: Linux System-Wide Logging</b></p> <ul style="list-style-type: none"> <li>8.1 Introduction to System-wide Logging</li> <li>8.2 Configuring System-Logging</li> </ul> <p><b>Unit 9: The Network Information Service</b></p> <ul style="list-style-type: none"> <li>9.1 Introduction to NIS</li> <li>9.2 Setting Up and Configuring an NIS server</li> </ul>
Reference Books	<ul style="list-style-type: none"> <li>1) TCP/IP Network Administration - Craig Hunt - O'Reilly &amp; Associates</li> <li>2) Managing NFS and NIS - Hal Stern - O'Reilly &amp; Associates</li> </ul>

	<ul style="list-style-type: none"> <li>3) DNS and BIND - Albitz/Liu - O'Reilly &amp; Associates</li> <li>4) Sendmail - Bryan Costales/Eric , Allman/Neil Rickert - O'Reilly &amp; Associates</li> <li>5) UNIX System Administration Handbook - Second Edition - Nemeth/Snyder/Seebass - Prentice Hall</li> <li>6) Red Hat Linux Networking and System Administration – Terry Collings, Kurt Wall</li> <li>7) Red Hat Linux 9 Bible - Christopher Negus</li> <li>8) Official Red Hat Linux User's Guide - Red Hat Inc.</li> <li>9) Official Red Hat Linux Administrator's Guide - Red Hat Inc.</li> <li>10) Red Hat Linux Security and Optimization - Mohammad J. Kabir</li> </ul>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 305: **Wireless Network and Mobile Computing**

Course Code	305
Course Title	<b>Wireless Network and Mobile Computing</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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	<p><b>Unit 1: Introduction to Wireless Network Technologies</b></p> <ol style="list-style-type: none"> <li>1.1 Introduction</li> <li>1.2 Standards</li> <li>1.3 Emerging Technologies</li> <li>1.4 OSI Basics</li> <li>1.5 LAN Basics</li> <li>1.6 LAN &amp; WAN Protocols</li> <li>1.7 Internet Protocol</li> </ol> <p><b>Unit 2: Wireless LAN Technologies, Implementation and Layers</b></p> <ol style="list-style-type: none"> <li>2.1 Frequency Hopping Spread Spectrum</li> <li>2.2 Direct Sequence Spread Spectrum (DSSS)</li> <li>2.3 Interference</li> <li>2.4 RF Math</li> <li>2.5 Service Sets</li> <li>2.6 Mobile IP</li> <li>2.7 Appropriate use and design of wireless Networking Multipath</li> <li>2.8 Co-location</li> <li>2.9 Power-over-Ethernet (PoE)</li> <li>2.10 Modulation and Bit Coding</li> <li>2.11 Fragmentation</li> <li>2.12 SIFS / PIFS / DIFS / EIFS</li> </ol> <p><b>Unit 3: Hardware Configuration, Implementation and Protocols</b></p> <ol style="list-style-type: none"> <li>3.1 Access Points</li> <li>3.2 Bridges</li> <li>3.3 Workgroup bridges</li> <li>3.4 Wireless Residential Gateways</li> <li>3.5 Host Connectivity</li> <li>3.6 Antennas, Cables, &amp; Connectors</li> <li>3.7 MAC and Routing Protocols for IEEE 802.11</li> <li>3.8 Wireless Mesh Networks</li> </ol> <p><b>Unit 4: MANET</b></p> <ol style="list-style-type: none"> <li>4.1. Various applications of MANET</li> <li>4.2. Destination- Sequenced Distance Vector protocol</li> <li>4.3. Dynamic Source Routing protocol</li> <li>4.4. Ad Hoc On-Demand Distance-Vector protocol</li> <li>4.5. Link Reversal Routing             <ol style="list-style-type: none"> <li>a. Gafni-Bertsekas algorithm</li> <li>b. Lightweight mobile routing algorithm.</li> </ol> </li> </ol>

	<p>4.6. Temporally ordered routing algorithm</p> <p><b>Unit 5: Introduction to Mobile Computing, GSM, GPRS &amp; WAP</b></p> <p>5.1 Mobility, Nomadic, Mobile and Ubiquitous computing</p> <p>5.2 Mobile Computing Architecture</p> <p>5.3 Mobile Computing Technologies ( Hardware, Software, Communication)</p> <p>5.4 Introduction to GSM</p> <p>5.5 GSM Architecture, Mobility Management, Network Signaling</p> <p>5.6 GPRS Architecture</p> <p>5.7 Network Nodes</p> <p>5.8 Mobile Internet Standards, WAP Gateway and Protocols</p> <p>5.9 WML</p>
Reference Books	<ol style="list-style-type: none"> <li>1) Wireless Local Area Network Fundamentals - Pejman Roshan, Jonathan Leary</li> <li>2) Wireless Networks First Step (First-step series) - Jim Geier</li> <li>3) 802.11 wireless network site surveying and installation - Bruce Alexander</li> <li>4) Introduction to Wireless and Mobile Systems by Cengage Learning (Thompson)</li> <li>5) J. Schiller, Mobile Communications, Addison –Wesley, 2003</li> <li>6) Wi-Fi Security - Stewart Miller</li> <li>7) Wireless and Mobile Network - Architecture Yi-Bing Lin &amp; Imrich Chlamtac - John Wiley &amp; Sons, 2001</li> <li>8) Mobile and Wireless Design Essentials by Martyn Mallick, John Wiley &amp; Sons</li> <li>9) Guide to Designing and Implementing wireless LANs - Mark Ciampa - Thomson learning , Vikas Publishing House, 2001</li> <li>10) Wireless Web Development - Ray Rischapter - Springer publishing, 2000</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 306: Programming Skills VIII

Course Code	306
Course Title	<b>Programming Skills VIII</b>
Credit	2
Teaching per Week	2 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	Learn practically IoT / ML
Course Objective	Learn IoT practically, understand the working of Micro-Controller & Micro-Computer and using various types of sensors and its Programming. OR Implement various algorithms used in Machine learning and introduce students with Programming in ML.
Pre-requisite	C/C++ for IoT OR Python Programming for ML
Course Outcome	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. OR After successful completion, students will be able to work with different types of ML algorithms and ML based application development.
Course Content	Practical based on paper no 301. (IoT/ML) Separate journal to be prepared for this subject 301.
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: 307: Programming Skills IX

Course Code	307
Course Title	<b>Programming Skills IX</b>
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 303. Separate journal to be prepared for this subject 303.
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: 308: Programming Skills X

Course Code	308
Course Title	<b>Programming Skills X</b>
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 304. Separate journal to be prepared for this subject 304.
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: 309: **Programming Skills XI**

Course Code	309
Course Title	<b>Programming Skills XI</b>
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 305. Separate journal to be prepared for this subject 305.
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 3rd  
Sem.  
(General  
Group)**

**Course: 301: Internet of Things (IoT)**  
(Elective)

Course Code	301
Course Title	<b>Internet of Things (IoT)</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 - 13. To make student understand IoT 14. To understand the working of Micro-Controller & Micro-Computer 15. To explain various types of sensors 16. To introduce students with Programming in IoT
Pre-requisite	C, C++
Course Outcome	After studying this course, student will be able to understand how Micro-Controller & Micro-Computer works. It will also help them 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	<p><b>Unit 1: Introduction to IoT</b></p> <ul style="list-style-type: none"> <li>1.1 What is IoT</li> <li>1.2 IoT Applications</li> <li>1.3 IoT Privacy and Security <ul style="list-style-type: none"> <li>1.3.1 Identification in Distributed Environment</li> <li>1.3.2 Device Authentication</li> </ul> </li> <li>1.4 IoT Botnet</li> </ul> <p><b>Unit 2: Networking and Communication</b></p> <ul style="list-style-type: none"> <li>2.1 Basics of Wireless Networking <ul style="list-style-type: none"> <li>2.1.1 CSMA/CA</li> </ul> </li> <li>2.2 IoT Network Protocols <ul style="list-style-type: none"> <li>2.2.1 BLE, Zigbee, LoRaWAN, RFID</li> </ul> </li> <li>2.3 IoT Data Protocols <ul style="list-style-type: none"> <li>2.3.1 CoAP, MQTT, XMPP, DDS</li> </ul> </li> </ul> <p><b>Unit 3: Sensors</b></p> <ul style="list-style-type: none"> <li>3.1 Introduction to Sensors</li> <li>3.2 Types of Sensors &amp; their working</li> <li>3.3 Wireless Sensor Network <ul style="list-style-type: none"> <li>3.3.1 Introduction to WSN</li> <li>3.3.2 Applications</li> <li>3.3.3 Characteristics</li> <li>3.3.4 Challenges</li> <li>3.3.5 Components</li> </ul> </li> <li>3.4 Wireless Adhoc Network Vs Wireless Sensor Network</li> </ul> <p><b>Unit 4: Micro-Controller: Arduino, NodeMCU</b></p> <ul style="list-style-type: none"> <li>4.1 Introduction to Microcontrollers</li> <li>4.2 Arduino IDE</li> <li>4.3 Arduino Architecture</li> </ul>

	<p>4.4 Arduino Pin Diagram</p> <p>4.5 Introduction to NodeMCU</p> <p>4.6 NodeMCU Specifications and Applications</p> <p>4.7 NodeMCU ESP8266 Pinout</p> <p><b>Unit 5: IoT App Interaction &amp; Introduction to Raspberry Pi</b></p> <p>5.1 Uploading sensor data to server</p> <p>5.2 Reading sensor data from server</p> <p>5.3 Controlling IoT device and components from Mobile or Web</p> <p>5.4 Introduction to Microcomputers</p> <p>5.5 Raspberry Pi Architecture</p> <p>5.6 Raspberry Pi Pinout</p>
Reference Books	<ol style="list-style-type: none"> <li>1) Getting Started with Internet of Things – By Cuno Pfister, O’Reilly</li> <li>2) Learning Internet of Things – By Peter Waher , Packt Publication</li> <li>3) Internet of Things : A Hands-on Approach – By Arshdip Bahga and Vijay Madisetti</li> <li>4) IoT Governance, Privacy and Security Issues, IERC</li> <li>5) IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Cisco Press</li> <li>6) Fundamentals of IoT Communication Technologies, Springer</li> <li>7) Microcontrollers – Architecture, Programming, Interfacing and system design – By Raj Kamal , Pearson</li> <li>8) Exploring C for Microcontrollers : A hands on approach, Springer</li> <li>9) Arduino for Dummies, Wiley</li> <li>10) Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media</li> <li>11) ESP8266: Get Started With ESP8266 Programming NodeMCU Using Arduino IDE, Createspace Independent Pub</li> <li>12) Internet of Things Projects with ESP32, Packt Publishing Limited</li> <li>13) Microprocessor Architecture, Programming and Applications with the 8085 - By Ramesh Gaonkar , Penram International Publishing</li> <li>14) Raspberry Pi for Dummies , Wiley</li> <li>15) Raspberry Pi User Guide – By Eben Upton and Garath Halfacree, Wiley</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

**Course: 301: Machine Learning**  
(Elective)

Course Code	301
Course Title	<b>Machine Learning (ML)</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	This course is an introduction for students to ML. The course also gives students an idea about various methods and algorithms of Machine Learning and application development of ML.
Course Objective	The objective of the course is – 1. To make student understand ML 2. To understand the various Machine Learning method 3. To explain various algorithms used in Machine learning 4. To introduce students with Programming in ML
Pre-requisite	Basics of Linear Algebra, Statistics and Mathematics, Python Programming
Course Outcome	After studying this, student will be able to understand how ML works. This course will also help students to appreciate the role of ML in industry environment. After successful completion, students will be able to work with different types of ML algorithms and ML based application development.
Course Content	<p><b>Unit 1 : Introduction</b></p> 1.1. Definition of Machine Learning 1.2 Types of Machine Learning : Supervised , Unsupervised and Semi-supervised 1.3 Applications and tools of Machine Learning (Scikit learn library) 1.4 Data Pre-processing, Selecting a model and training a model 1.5 Evaluating a performance of model and improving performance
	<p><b>Unit 2 : Data Wrangling</b></p> 2.1 Definition and goal of Data Wrangling 2.2 Importance of Data Wrangling 2.3 Data Pre-processing and Data Cleaning 2.3.1 Data Cleaning 2.3.2 Data Transformation 2.3.3 Data Reduction 2.3.4 Data Discretization 2.3.5 Feature Selection 2.4 Data Visualization
	<p><b>Unit 3 : Supervised Learning</b></p> 3.1 Supervised Learning : Classification and Regression 3.2 Regression 3.2.1 Simple and Multiple Regression 3.2.2 Linear Regression 3.2.3 Gradient Decent 3.2.4 Logistic Regression 3.3 Classification Algorithms : 3.3.1 K-nearest Neighbour

	<p>3.3.2 Support Vector Machines  3.3.3 Decision Trees  3.3.4 Naïve Bayes Classifier  3.4 Introduction to Support Vector Machine</p> <p><b>Unit 4 : Neural Network</b>  4.1 Introduction to Neural Network  4.2 Architecture of Neural Network  4.3 Feedforward network and Backpropagation with example  4.4 Applications of Neural Network</p> <p><b>Unit 5 : Unsupervised Learning</b>  5.1 Introduction to Unsupervised learning  5.2 Clustering  5.2.1 Selection of Clusters  5.2.2 Algorithms :  5.2.2.1 K – means clustering  5.2.2.2 Hierarchical Clustering  5.3 Association Rule Learning  5.3.1 Algorithms :  5.3.1.1 FP- Growth  5.3.1.2 Apriori Algorithm</p>
Reference Books	<ol style="list-style-type: none"> <li>1. “Machine Learning” by Tom M. Mitchell, McGraw Hill</li> <li>2. “Understanding Machine Learning” by Shai Shalev-Shwartz, Shai Ben-David</li> <li>3. “Machine Learning” by Anuradha Srinivasaraghavan, Vincy Joseph</li> <li>4. “Machine Learning using Python” by U Dinesh Kumar Manaranjan Pradhan</li> <li>5. “Real-World Machine Learning” by Henrik Brink, Joseph Richards, Mark Fetherolf</li> <li>6. “Python Machine Learning” by Sebastian Raschka and Vahid Mirjalili</li> <li>7. “Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems” by Aurelien Geron</li> <li>8. “Machine Learning in Action” by Peter Harrington</li> <li>9. “Introduction to Machine Learning with Python : A Guide for Data Scientists” by Andreas C. Muller, Sarah Guido</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 302: Design Patterns

Course Code	302
Course Title	<b>Design Patterns</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	The purpose of the course is to make student understand how Patterns can be implemented in various object oriented programming languages to solve real world problems.
Course Objective	The objective of the course is - <ol style="list-style-type: none"> <li>7. To study various Design Patterns</li> <li>8. How these Patterns can be used to design better systems through Object Oriented Programming Languages</li> </ol>
Pre-requisite	Object Oriented Programming, Software Engineering
Course Outcome	After completion of this course, the student will be capable of implementing various Design Patterns in different Object Oriented Programming languages.
Course Content	<p><b>Unit -1 Creational Patterns</b></p> <ol style="list-style-type: none"> <li>1.1 Singleton Pattern</li> <li>1.2 Prototype Pattern</li> <li>1.3 Builder Pattern</li> <li>1.4 Factory Method Pattern</li> <li>1.5 Abstract Factory Pattern</li> </ol> <p><b>Unit-2 Structural Patterns</b></p> <ol style="list-style-type: none"> <li>2.1 Proxy Pattern</li> <li>2.2 Decorator Pattern</li> <li>2.3 Adapter Pattern</li> <li>2.4 Façade Pattern</li> <li>2.5 Flyweight Pattern</li> <li>2.6 Composite Pattern</li> <li>2.7 Bridge Pattern</li> </ol> <p><b>Unit-3 Behavioural Pattern</b></p> <ol style="list-style-type: none"> <li>3.1 Visitor Pattern</li> <li>3.2 Observer Pattern</li> <li>3.3 Strategy Pattern</li> <li>3.4 Template Method Pattern</li> <li>3.5 Command Pattern</li> <li>3.6 Iterator Pattern</li> <li>3.7 Memento Pattern</li> <li>3.8 State Pattern</li> <li>3.9 Mediator Pattern</li> <li>3.10 Interpreter Pattern</li> </ol> <p><b>Unit-4 Additional Design Patterns</b></p> <ol style="list-style-type: none"> <li>4.1 Simple Factory Pattern</li> <li>4.2 Null Object Pattern</li> <li>4.3 MVC Pattern</li> </ol> <p><b>Unit-5 Pattern Applicability</b></p> <ol style="list-style-type: none"> <li>5.1 Security Patterns Repository</li> <li>5.2 Patterns for Agile Development</li> <li>5.3 Restful Service Patterns</li> <li>5.4 Solution with semaphore</li> </ol>

	<p>5.5 Patterns and Pattern combination in practice</p> <p>5.6 Big Ball of Mud</p> <p><b>Self-Study :</b> Pattern Languages</p>
Reference Books	<p>19. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph, John, Addison Wesley</p> <p>20. Head First Design Patterns, Eric Freeman, O'Reilly</p> <p>21. Design Patterns in C#, Vaskaran Sarcar, Apress</p> <p>22. Design Patterns in Modern C++, Reusable Approaches for Object-Oriented Software Design, Dmitri Nesteruk, Apress</p> <p>23. Modern C++ design: generic Programming and design patterns applied, Alexandrescu, Andrei, Addison-Wesley</p> <p>24. Java Design Patterns: A Hands-on Experience with Real-World Examples, Vaskaran Sarcar, Apress</p>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30 % internal assessment and 70% external assessment

## Course: 303: Network Essentials and its Security

Course Code	303
Course Title	<b>Network Essentials and its Security</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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	<p><b>Unit 1: Network Essentials</b></p> <ul style="list-style-type: none"> <li>1.1 Repeaters &amp; Bridges <ul style="list-style-type: none"> <li>1.1.1 LAN Expansion</li> <li>1.1.2 Repeaters</li> <li>1.1.3 Bridges</li> <li>1.1.4 How Bridges Work</li> <li>1.1.5 Creating the routing table</li> <li>1.1.6 Segmenting Network Traffic</li> <li>1.1.7 Remote Bridges</li> <li>1.1.8 Differentiating between bridges and repeaters</li> </ul> </li> <li>1.2 Routers &amp; Gateways <ul style="list-style-type: none"> <li>1.2.1 Routers</li> <li>1.2.2 How routers work</li> <li>1.2.3 Routing benefits</li> <li>1.2.4 Routing protocols</li> <li>1.2.5 Routing V/S Bridging</li> <li>1.2.6 B Routers</li> <li>1.2.7 Gateways</li> <li>1.2.8 How Gateways work</li> </ul> </li> <li>1.3 Network Administration <ul style="list-style-type: none"> <li>1.3.1 Bottlenecks</li> <li>1.3.2 Simple Network Management Protocol</li> <li>1.3.3 Data Protection</li> <li>1.3.4 Backup Methods</li> <li>1.3.5 Testing and Storage</li> <li>1.3.6 Implementing a Backup System</li> <li>1.3.7 Uninterruptible Power Suppliers</li> <li>1.3.8 How Gateways work</li> <li>1.3.9 Implementing Fault Tolerant Systems</li> <li>1.3.10 RAID</li> <li>1.3.11 Sector Sparing</li> </ul> </li> <li>1.4 Advance WAN Transmission <ul style="list-style-type: none"> <li>1.4.1 Overview</li> <li>1.4.2 Multiplexing, Packet and Circuit Switching Networks</li> <li>1.4.3 X.25</li> <li>1.4.4 Asynchronous Transfer Mode (ATM)</li> <li>1.4.5 ISDN</li> <li>1.4.6 SONET</li> <li>1.4.7 SMDS</li> </ul> </li> </ul> <p><b>Unit 2: Introduction to Network Security</b></p> <p><b>Unit 3: Cryptography Techniques</b></p> <ul style="list-style-type: none"> <li>3.1 Classical Cryptography</li> </ul>

	<p>3.2 Conventional Cryptography  3.2.1 DES</p> <p>3.3 Public – key Cryptography  3.3.1 RSA</p> <p>3.4 Digital Signatures  3.4.1 DSA</p> <p><b>Unit 4: Security Services</b>  16.1 Message Integrity  16.2 Confidentiality and Authentication  16.3 Certification and Key Management  4.3.1 PKI</p> <p><b>Unit 5: Network Security Applications</b>  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</p> <p><b>Unit 6: Access Control in Computer Networks</b>  6.1 Authentication Protocols and Services  6.1.1 Kerberos and X.309  6.2 Firewalls  6.3 Virtual Private Networks (VPNs)</p> <p><b>Unit 7: System Security</b>  7.1 Intrusion detection  7.2 Viruses</p> <p><b>Unit 8: Mobile System &amp; E-Commerce Securities</b>  8.1 3G Security  8.2 E-Payment Systems  8.3 Fair Data Exchange</p>
Reference Books	<ol style="list-style-type: none"> <li>1. Cryptography and Network Security, 2/e, ISBN: 0-13-869017-0 - W. Stallings - Pearson Education, 1999</li> <li>2. Network Security Essentials: Applications and Standards, 1/e, ISBN: 0-13-016093-8 - W. Stallings - Pearson Education, 2000</li> <li>3. SSL and TLS: designing and building secure systems, ISBN: 0-201-61598-3 - E. Rescorla - Addison-Wesley, 2001</li> <li>4. Implementing Secure Intranets and Extranets, ISBN: 0-89006-447-4 - K M Phaltankar - Artech House Publishers, 2000</li> <li>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</li> <li>6. Security in Computing, ISBN: 0-13-185794-0, 2/e - C. P. Pfleeger - Prentice Hall, 1997</li> <li>7. Building Internet Firewalls, 2/e, ISBN: 1-56592-871-7 - E. D. Zwicky, et al - O'Reilly, 2000</li> <li>8. CDMA Cellular Mobile Communications &amp; Network Security, ISBN: 0-13-598418-1 - M. Y. Rhee, - Prentice Hall, 1998</li> <li>9. Journal of Computer Security</li> <li>10. ACM Transactions on Information and System Security</li> <li>11. ACM Conference on Computer and Communications Security</li> <li>12. IEEE Symposium on Security and Privacy</li> </ol>

	<p>13. Internet documents - RFCs (Request for Comments)</p> <p>14. Guide to Networking Essentials, Fourth Edition - Greg Tomsho, et al</p> <p>15. Computer Networking Essentials - Debra Littlejohn Shinder</p> <p>16. Networking Essentials: Hands-On, Self-Paced Training for Supporting Local and Wide Area Networks - Microsoft Corporation (Corporate Author)</p> <p>17. Computer Network - A. S. Tanenbaum</p>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 304: Advanced Database Administration

Course Code	304
Course Title	<b>Advanced Database Administration</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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	<p><b>Unit 1. Oracle10g Instance creation and management</b></p> <ol style="list-style-type: none"> <li>1.1 Oracle Instance</li> <li>1.2 Installing Oracle</li> <li>1.3 Oracle Optimal Flexible Architecture (OFA)</li> <li>1.4 Locating initialization, listener.ora &amp; sqlnet.ora files</li> <li>1.5 Finding the alert log</li> <li>1.6 Common environment variables</li> <li>1.7 Structures in an Oracle Instance</li> <li>1.8 Oracle Memory Structures, SGA and PGA</li> <li>1.9 Oracle Processes and their purposes</li> <li>1.10 Startup, nomount, mount and open database commands</li> </ol> <p><b>Unit 2. Oracle10g Database Architecture</b></p> <ol style="list-style-type: none"> <li>2.1 Oracle10g management framework</li> <li>2.1 Using the Database Creation Assistant (DBA)</li> <li>2.3 Creating and dropping a database</li> <li>2.4 Tablespaces</li> <li>2.5 Tables and Indexes</li> <li>2.6 Clusters</li> <li>2.7 Partitioning of Tables and Indexes</li> <li>2.8 Gathering and applying patches</li> </ol> <p><b>Unit 3. Concurrency Management</b></p> <ol style="list-style-type: none"> <li>3.1 Transactions, serialization, locks and latches</li> <li>3.2 Lock modes</li> <li>3.3 Detecting and resolving lock conflicts</li> <li>3.4 Managing deadlocks</li> </ol> <p><b>Unit 4. Interfacing with Oracle</b></p> <ol style="list-style-type: none"> <li>4.1 Oracle transaction management</li> <li>4.2 Using SQL*Plus and iSQL*Plus</li> <li>4.3 Using embedded Oracle with Pro*C &amp; Java</li> <li>4.4 PL/SQL &amp; Triggers</li> <li>4.5 Pining PL/SQL packages &amp; compiling PL/SQL</li> <li>4.6 System-level triggers – startup trigger, logon trigger, PL/SQL error trigger</li> </ol> <p><b>Unit 5. Oracle*Net</b></p> <ol style="list-style-type: none"> <li>5.1 Basic Network structure</li> <li>5.2 Oracle*Net Files</li> <li>5.3 Multi-threaded server</li> <li>5.4 Create additional listeners</li> <li>5.5 Create Oracle Net service aliases</li> </ol>

- 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 v\$db\_cache\_advice, v\$shared 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**

	<p>12.1 Oracle backup &amp; recovery planning</p> <p>12.2 Parallel instance recovery</p> <p>12.3 Basics of checkpoints, redo log files, and archived log files</p> <p>12.4 Using ARCHIVELOG mode</p> <p>12.5 Creating consistent Oracle backups</p> <p>12.6 Online hot backups</p> <p>12.7 Incremental Oracle backups</p> <p>12.8 Automating database backups with dbms_scheduler</p> <p>12.9 Monitor the flash recovery area</p> <p>12.10 Recovering from loss of a Control file</p> <p>12.11 Recovering from loss of a Redo log file</p> <p>12.12 Recovering from loss of a system-critical data file</p> <p>12.13 Recovering from loss of a non system-critical data file</p>
Reference Books	<ol style="list-style-type: none"> <li>1. Essentials : Oracle Database 10g by Rick Greenwald, Robert Stackowiak, Jonathan Stern, O'Reilly</li> <li>2. Oracle High Performance Tuning for 9i and 10g by Gavin Powell, Digital Press</li> <li>3. Oracle Database 10g, DBA Handbook by Loney, Kevin, Bryla, Bob, Oracle Press</li> <li>4. Oracle Database 10g - The Complete Reference by Loney, Kevin, Oracle Press</li> <li>5. Oracle Database 10g: A Beginner's Guide by Micheal Abbey, Ian Abramson Osborne, Oracle Press Series</li> </ol>
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 305: Open Source Web Based Programming

Course Code	305
Course Title	<b>Open Source Web Based Programming</b>
Credit	4
Teaching per Week	4 Hrs.
Minimum weeks/ Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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	<p><b>Unit 1 : Introduction to Open source Web based Programming</b></p> <ul style="list-style-type: none"> <li>1.1 Introduction to PHP &amp; MySql</li> <li>1.2 Installation of PHP and MySql</li> <li>1.3 Language Characteristics &amp; Features</li> <li>1.4 Operators and Variables, Control Structures, Looping and Error handling</li> <li>1.5 PHP functions <ul style="list-style-type: none"> <li>1.5.1 String Functions</li> <li>1.5.2 Array Functions</li> <li>1.5.3 Mathematical Functions</li> <li>1.5.4 Graphics Library (GD Support)</li> <li>1.5.6 Date and Time Functions</li> <li>2.5.7 Misc. Function</li> </ul> </li> <li>1.6 State management Techniques</li> <li>1.7 Object Oriented Features of PHP <ul style="list-style-type: none"> <li>1.7.1 Classes and Objects</li> <li>1.7.2 Use of constructors</li> <li>1.7.3 Serialization</li> <li>1.7.4 Inheritance</li> </ul> </li> </ul> <p><b>Unit 2 : MySQL database server</b></p> <ul style="list-style-type: none"> <li>2.1 Configuring the MySQL Server</li> <li>2.2 MySQL Tables, Displaying MySQL Database , Adding and removing user access</li> <li>1.3 Database connection and data processing functions</li> </ul> <p><b>Unit 3 : Advance PHP</b></p> <ul style="list-style-type: none"> <li>3.1 Ajax Basics <ul style="list-style-type: none"> <li>3.1.1 HTTP Request and Response Fundamentals</li> <li>3.1.2 The XMLHttpRequest Object XMLHttpRequest Methods</li> <li>3.1.3 XMLHttpRequest Properties</li> <li>3.1.4 Cross-Browser Usage Sending a Request to the Server</li> <li>3.1.5 PHP and Ajax Client-Driven Communication</li> <li>3.1.6 Server-Side Processing Expanding and Contracting Content</li> <li>3.1.7 Form Validation</li> <li>3.1.8 Ajax-Based Database Querying</li> </ul> </li> <li>3.2 XML</li> <li>3.3 Web services</li> </ul>

	<p><b>Unit 4 : MVC</b></p> <ul style="list-style-type: none"> <li>4.1 Introduction to MVC</li> <li>4.2 CodeIgniter: Introduction, Features and Application Flow Chart</li> <li>4.3 Controller</li> <li>4.4 Views</li> <li>4.5 Models</li> <li>4.6 Helpers</li> <li>4.7 Creating and Usage of Libraries and Helpers</li> <li>4.8 URL Routing</li> <li>4.9 Error Handling</li> <li>4.10 Profiling Application</li> </ul> <p><b>Unit 5 : Introduction to React JS</b></p> <ul style="list-style-type: none"> <li>5.1 What is React JS</li> <li>5.2 Environment Setup</li> <li>5.3 JSX and ES6</li> <li>5.4 Components</li> <li>5.5 Props and State</li> <li>5.6 Components API and Lifecycle</li> <li>5.7 Forms and Events</li> <li>5.8 Difference between React JS and React Native</li> </ul>
Reference Books	<ol style="list-style-type: none"> <li>1. Beginning PHP, Apache, MySQL Web Development - Elizabeth Naramore, Jason Gerner , Yann Le Scouarnec,Jeremy Stolz,Michael K. Glass, Gary Mailer – Wrox Publication</li> <li>2. Professional PHP Programming - Jesus Castagnetto ,Wrox Press Ltd</li> <li>3. Beginning PHP and MySQL: From Novice to Professional - W. Jason Gilmore, Apress</li> <li>4. Php: The Complete Reference - Steven Holzner, Tata Mcgraw Hill Education Private Limited</li> <li>5. AJAX and PHP: Building Responsive Web Applications - Bogdan Brinzarea, Cristian Darie packtpub</li> <li>6. CodeIgniter for Rapid PHP Application Development - David Upton ,packtpub</li> <li>7. Professional CodeIgniter- Thomas Myer, Wrox Press Ltd</li> <li>8. Learning React - Kirupa Chinnathambi , Paperback – 2018</li> <li>9. Mastering React- Adam Horton and Ryan Vice, packtpub</li> <li>10. Php manual – www. Php.com</li> </ol>
Teaching Methodology	Class work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	<p>30% Internal assessment is based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc.</p> <p>70% assessment is based on semester end University External examination</p>

## Course: 306: Programming Skills VIII

Course Code	306
Course Title	<b>Programming Skills VIII</b>
Credit	2
Teaching per Week	2 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
Purpose of Course	Learn practically IoT / ML
Course Objective	Learn IoT practically, understand the working of Micro-Controller & Micro-Computer and using various types of sensors and its Programming. OR Implement various algorithms used in Machine learning and introduce students with Programming in ML.
Pre-requisite	C/C++ for IoT OR Python Programming for ML
Course Outcome	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. OR After successful completion, students will be able to work with different types of ML algorithms and ML based application development.
Course Content	Practical based on paper no 301. (IoT/ML) Separate journal to be prepared for this subject 301.
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: 307: Programming Skills IX

Course Code	307
Course Title	<b>Programming Skills IX</b>
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 303. Separate journal to be prepared for this subject 303.
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: 308: Programming Skills X

Course Code	308
Course Title	<b>Programming Skills X</b>
Credit	2
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 304. Separate journal to be prepared for this subject 304.
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: 309: Programming Skills XI

Course Code	309
Course Title	<b>Programming Skills XI</b>
Credit	3
Teaching per Week	3 Hrs.
Minimum weeks/ Semester	15 (Including Lab. work, examination, preparation, holidays etc.)
Review / Revision	June 2021
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 305. Separate journal to be prepared for this subject based on 305.
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**

**4<sup>th</sup> Sem.**

## Course: 401: **Seminar**

Course Code	401
Course Title	<b>Seminar</b>
Credit	6
Review / Revision	June 2021

- 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: 402: **Project**

Course Code	402
Course Title	<b>Project</b>
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)