

**BHARATI VIDYAPEETH
DEEMED TO BE UNIVERSITY
PUNE, INDIA
FACULTY OF MANAGEMENT STUDIES**

**Board of Studies in Computer Applications
Master of Computer Applications Programme
(Under Choice Based Credit System)
To be effective from 2018-19 at Part I**

1. INTRODUCTION

The MCA Program is a full time 150 Credits programme offered by Bharati Vidyapeeth Deemed to be University, Pune and conducted at its management institutes in Pune, Karad, Kolhapur, Sangli, and Solapur. All the five institutes have excellent faculties, Laboratories, Library, and other facilities to provide proper learning environment. The University is reaccredited by NAAC with an 'A+' grade (3rd cycle). The expectations and requirements of the software industry, immediately and in the near future, are visualized while designing the MCA programme. This effort is reflected in the Vision and Mission statements of the MCA programme. Of course, the statements also embody the spirit of the vision of Late Dr. Patangraoji Kadam, the Founder of Bharati Vidyapeeth and Chancellor, Bharati Vidyapeeth Deemed to be University which is to usher in “Social Transformation through Dynamic Education.”

2. VISION STATEMENT OF MCA PROGRAMME

To create high caliber solution architects and innovators for software development.

3. MISSION STATEMENT OF MCA PROGRAMME

To teach 'things, not just words', 'how to think', and 'how to self-learn'.

4. OBJECTIVES OF THE MCA PROGRAMME

The main objectives of MCA Programme are to prepare the youth to take up positions as system analysts, system engineers, software engineers, programmers and of course as versatile teachers in any area of computer applications. Accordingly the course curriculum aims at developing 'systems thinking' 'abstract thinking', 'skills to analyze and synthesize', and 'skills to apply knowledge', through 'extensive problem solving sessions', 'hands on practice under various hardware/software environments', 'four minor projects and 'one semester full-time internship project'. In addition, 'social interaction skills', 'communication skills', 'life skills', 'entrepreneurial skills', and 'research skills' which are necessary for career growth and for leading quality life are also imparted.

5. LEARNING OUTCOMES FROM THE MCA PROGRAMME:

At the end of the course the student should be able to:

- (a) Analyze problems and design effective and efficient software solutions.
- (b) Develop software under latest Application Development Environments.
- (c) Learn new technologies with ease and be productive at all times.
- (d) Read, write, and contribute to technical literature.
- (e) Work in teams.
- (f) Be a good citizen in all respects.

6. ELIGIBILITY FOR ADMISSION TO THIS PROGRAMME:

Admission to the programme is open to any candidate (Graduate) of any recognized University satisfying the following conditions.

1. The candidate should have secured at least 50% (45% for SC/ST).
2. Mathematics as one of the subject at 12th or graduation.

7 DURATION OF THE PROGRAMME

The duration of this programme is three years divided in to six semesters or a minimum of 150 credits whichever is later. The medium of instruction and examination will be only English.

8 SCHEME OF EXAMINATION:

For some courses there is Internal Assessment (IA) conducted by the respective institutes as well as a University Examination (UE) at the End-of-the Term. UE will be conducted out of 60 marks and IA will be conducted for 40 marks then these are converted to grade points and grades as per the Table I. For courses having only Continuous Assessment (CA) the respective institutes will evaluate the students in varieties of ways, three or four times, during the term for a total of 100 marks. Then the marks will be converted to grade points and grades using the Table I.

9 STANDARD OF PASSING:

For all courses, both UE and IA constitute separate heads of passing (HoP). In order to pass in such courses and to earn the assigned credits, the learner must obtain a minimum grade point of 5.0 (40% marks) at UE and also a minimum grade point of 5.0 (40% marks) at IA.

A student who fails at UE in a course has to reappear only at UE as backlog candidate and clear the Head of Passing. Similarly, a student who fails in a course at IA has to reappear only at IA as backlog candidate and clear the Head of Passing to secure the GPA required for passing.

The 10 point Grades and Grade Points according to the following table:

Range of Marks (%)	Grade	Grade Point
$80 \leq \text{Marks} \leq 100$	O	10
$70 \leq \text{Marks} < 80$	A+	9
$60 \leq \text{Marks} < 70$	A	8
$55 \leq \text{Marks} < 60$	B+	7
$50 \leq \text{Marks} < 55$	B	6
$40 \leq \text{Marks} < 50$	C	5
Marks < 40	D	0

Table 1

The performance at UE and IA will be combined to obtain GPA (Grade Point Average) for the course. The weights for performance at UE and IA shall be 60% and 40% respectively.

GPA is calculated by adding the UE marks out of 60 and IA marks out of 40. The total marks out of 100 are converted to grade point, which will be the GPA.

10 Formula to calculate Grade Points (GP)

Suppose that „Max“ is the maximum marks assigned for an examination or evaluation, based on which GP will be computed. In order to determine the GP, Set $x = \text{Max}/10$ (since we have adopted 10 point system). Then GP is calculated by the following formulas

Range of Marks	Formula for the Grade Point
$8x \leq \text{Marks} \leq 10x$	10
$5.5x \leq \text{Marks} < 8x$	Truncate (M/x) +2
$4x \leq \text{Marks} < 5.5x$	Truncate (M/x) +1

Table 2

Two kinds of performance indicators, namely the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA) shall be computed at the end of each term. The SGPA measures the cumulative performance of a learner in all the courses in a particular semester, while the CGPA measures the cumulative performance in all the courses since his/her enrollment. The CGPA of learner when he /she completes the programme is the final result of the learner.

The SGPA is calculated by the formula

$$SGPA = \frac{\sum C_k * GP_k}{\sum C_k}$$

where, C_k is the Credit value assigned to a course and GP_k is the GPA obtained by the learner in the course. In the above, the sum is taken over all the courses that the learner has undertaken for the study during the Semester, including those in which he/she might have failed or those for which he/she remained absent. **The SGPA shall be calculated up to two decimal place accuracy.**

The CGPA is calculated by the following formula

$$CGPA = \frac{\sum C_k * GP_k}{\sum C_k}$$

where, C_k is the Credit value assigned to a course and GP_k is the GPA obtained by the learner in the course. In the above, the sum is taken over all the courses that the learner has undertaken for the study from the time of his/her enrollment and also during the semester for which CGPA is calculated. **The CGPA shall be calculated up to two decimal place accuracy.**

The formula to compute equivalent percentage marks for specified CGPA:

%marks (CGPA)	$(10 * CGPA) - 10$	If $5.00 \leq CGPA < 6.00$
	$(5 * CGPA) + 20$	If $6.00 \leq CGPA < 8.00$
	$(10 * CGPA) - 20$	If $8.00 \leq CGPA < 9.00$
	$(20 * CGPA) - 110$	If $9.00 \leq CGPA < 9.50$
	$(40 * CGPA) - 300$	If $9.50 \leq CGPA \leq 10.00$

Table 3

11 Award of Honours:

A student who has completed the minimum credits specified for the programme shall be declared to have passed in the programme. The final result will be in terms of letter grade only and is based on the CGPA of all courses studied and passed. The criteria for the award of honours are given below.

Range of CGPA	Final Grade	Performance Descriptor	Equivalent Range of Marks (%)
9.5≤CGPA ≤10	O	Outstanding	80≤Marks≤100
9.0≤CGPA ≤9.49	A+	Excellent	70≤Marks<80
8.0≤CGPA ≤8.99	A	Very Good	60≤Marks<70
7.0≤CGPA ≤7.99	B+	Good	55≤Marks<60
6.0≤CGPA ≤6.99	B	Average	50≤Marks<55
5.0≤CGPA ≤5.99	C	Satisfactory	40≤Marks<50
CGPA below 5.0	F	Fail	Marks below 40

Table 4

RULES OF ATKT:

1. A student is allowed to carry backlog of any number of subjects upto Semester IV.
2. A student must pass Part I (Semester I and II) to appear for Semester V.

SEMESTER WISE COURSE STRUCTURE FOR MCA**(To be effective from July 2018)****SEMESTER I**

Course Number	Course Title	Credits	Hours/Week			IA Marks	EoTE Marks
			L	T	P		
101	C Programming	4	3	1	-	40	60
102	Computer Organization And Architecture	4	3	1	-	40	60
103	Database Management Systems	4	3	1	-	40	60
104	Discrete Structures	3	2	1	-	40	60
105	Management Functions	3	2	1	-	40	60
106	Web Supporting Technologies	4	2	-	4	40	60
107	C Lab	2	0	-	4	40	60
108	Soft Skills	2	2	-	-	50	0
109	Self learning-1 (Societal Related Topic)	2	0	-	-	50	0
Total		28	17	5	8	380	420

SEMESTER II

Course Number	Course Title	Credits	Hours/Week			IA Marks	EoTE Marks
			L	T	P		
201	Data structure and Algorithms	4	3	1	-	40	60
202	Operating Systems	4	3	1	-	40	60
203	Software Engineering	4	3	1	-	40	60
204	Statistical Techniques	3	2	1	-	40	60
205	Financial Accounting	3	2	1	-	40	60
206	Database Management Systems Lab	4	2	-	4	40	60
207	Data Structures Lab	2	0	-	4	40	60
208	Project-I	2	2	-	-	0	100
209	Self-learning-2 (Societal Related Topic)	2	0	-	-	50	0
Total		28	17	5	8	330	520

SEMESTER III

Course Number	Course Title	Credits	Hours/Week			IA Marks	EoTE Marks
			L	T	P		
301	Artificial Intelligence	4	3	1	-	40	60
302	Computer Networks	4	3	1	-	40	60
303	Object Oriented Analysis And Design	4	3	1	-	40	60
304	Probability and Graph theory	3	2	1	-	40	60
305	Organizational Behaviour	3	2	1	-	40	60
306	Object Oriented Programming	4	3	1	0	40	60
307	Object Oriented Programming Lab	2	0	-	4	40	60
308	Project-II	2	2	-	-	0	100
309	Self learning-3 (Societal Related Topic)	2	0	-	-	50	0
Total		28	18	6	4	330	520

SEMESTER IV

Course Number	Course Title	Credits	Hours/Week			IA Marks	EoTE Marks
			L	T	P		
401	Data Warehousing and Data Mining	4	3	1	-	40	60
402	Information Security	4	3	1	-	40	60
403	Design Patterns	4	3	1	-	40	60
404	Elective-I	3	2	1	-	100	-
405	Elective-II	3	2	1	-	100	-
406	Lab Elective-I	4	2	-	4	40	60
407	Linux Lab	2	0	-	4	40	60
408	Project-III	2	2	-	-	0	100
409	Self learning-4 (Computer Related Topic)	2	0	-	-	50	-
Total		28	17	5	8	450	400

SEMESTER V

Course Number	Course Title	Credits	Hours/Week			IA Marks	EoTE Marks
			L	T	P		
501	Data Science	4	3	1	-	40	60
502	Optimization Techniques	4	3	1	-	40	60
503	Software Project Management	4	3	1	-	40	60
504	Elective-III	3	2	1	-	100	-
505	Elective-IV	3	2	1	-	100	-
506	Lab Elective-II	4	2	-	4	40	60
507	Lab on Current Trends	2	0	-	4	40	60
508	Project-IV	2	2	-	-	0	100
509	Self learning-5 (Computer Related Topic)	2	0	-	-	50	0
Total		28	17	5	8	450	400

List of Elective Groups:

These are the broad Elective groups and a student can select only one group for his specialization. Each group will have 4 subjects, of which a student will study first 2 in Semester IV and other 2 in Semester V.

Elective Group
Cloud Computing
Data Analytics
Linux
Open Source Technologies
Mobile Computing
Dot Net Technologies
Net Centric Technologies
Information Systems
IOT
Big Data
Cyber Security

Elective No.	Elective Group	Course No	Course Name
01	Cloud Computing	404-01-A	Virtualization
		405-01-B	Cloud Computing Concepts
		504-01-C	Cloud Solutions
		505-01-D	Cloud Computing
02	Data Analytics	404-02-A	Algorithms for Advanced Analytics
		405-02-B	Machine Learning Techniques
		504-02-C	Weka
		505-02-D	Statistical Computing
03	Linux	404-03-A	Linux Desktop Environment and Shell Programming
		405-03-B	Linux System Administration
		504-03-C	Linux Network Administration
		505-03-D	Linux Internals and Network
04	Open Source Technologies	404-04-A	Python
		405-04-B	Perl Scripting
		504-04-C	PHP
		505-04-D	Ruby
05	Mobile Computing	404-05-A	HTML 5
		405-05-B	Java Script Programming
		504-05-C	Android
		505-05-D	Hybrid Application Development
06	Dot Net Technologies	404-06-A	C# Programming
		405-06-B	ASP .NET with C#
		504-06-C	C# Windows Programming
		505-06-D	MVC
07	Net Centric Technologies	404-07-A	HTML 5
		405-07-B	Java Script Programming
		504-07-C	Ajax Programming
		505-07-D	Web Services
08	Information Systems	404-08-A	Enterprise Resource Planning
		405-08-B	E Commerce
		504-08-C	Recommender System
		505-08-D	Knowledge Management
09	IOT	404-09-A	IoT Architecture And Protocols
		405-09-B	Sensors and Fundamentals with Hands-on lab Node.js/Raspberry PI/Python
		504-09-C	Internet Of Things: Sensing And Actuator Devices
		505-09-D	Smart city use case, MQTT, Integrating on Cloud
10	Big Data	404-10-A	Business Intelligence Applications
		405-10-B	Business Intelligence Tools
		504-10-C	Introduction to Big Data
		505-10-D	Hadoop
11	Cyber Security	404-11-A	Cyber Security
		405-11-B	Information Security Concepts
		504-11-C	Information Security Threats
		505-11-D	Information Security Administration

SEMESTER VI

Course Number	Course Title	Credits	Hours/Week			IA Marks	EoTE Marks
			L	T	P		
601	Internship Project	10	-	-	-		100

Practical Examinations:

For course Nos. 106,107,206,207,307,406,407,506 and 507 there will be practical examination.

For course No 507 Lab on Current Trends, Every center can decide the Programming Language to be taught depending upon the current industry demand and students interest.

Project Viva:

For course Nos. 208,308,408,508 there will be University Project Dissertation Viva carrying 100 marks.

Self Learning:

For Self Learning- 1 (109), Self Learning- 2 (209), Self Learning- 3 (309), Self Learning- 4 (409), Self Learning- 5 (509), students should select any one recent/upcoming topic related to Societal Concerns (SEM I to SEM III) and on computer science (SEM IV and V) , study it thoroughly and submit a project report at the end of the semester.

SEMESTER V

Course Number	Course Name	L-T-P- Credits	Year of Introduction
501	Data Science	3L+1T+0P= 4C	2018-19
Course Objective :			
You will learn data science basics, statistics, R programming fundamentals of big data, hadoop and mapreduce, and Machine Learning Basics. By the end of this students should be able to handle and program on machine learning techniques using R-tool			
References (Books, Websites etc) :			
Refer web sources			
Suggested MOOC :			
Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus:			
Unit	Contents		
1	Introduction To Data Science: What is data science, relation to data mining, machine learning, big data and statistics, Several data science settings, Introduction to the WEKA tool		
2	Data analysis: From data to features: Interactive group discussion, Representing problems with matrices, Representing problem with relations, Examples Computing simple statistics: Means, variances, standard deviations, weighted averaging, modes, quartiles, Examples Simple visualizations: Histograms, Boxplots, Scatterplots, Time series, Spatial data Case studies: X & Y examples, Medical data ,Hands-on R-Tool		
3	Exploratory Data Mining: Introduction to Exploratory Data Mining, Association discovery What is association discovery?, What are the challenges? , In detail: Apriori Clustering What is clustering? , What are the challenges? ,In detail: agglomerative clustering Hands-on: clustering in WEKA		
4	Evaluation And Methodology Of Data Science: Experimental setup Training, tuning, test data, Holdout method, cross-validation, bootstrap method Measuring performance of a model Accuracy, ROC curves, precision-recall curves, Loss functions for regression		

	<p>Interpretation of results Confidence interval for accuracy Hypothesis tests for comparing models, algorithms</p>
5	<p>Data Engineering: Attribute selection Filter methods, Wrapper methods Data discretization Unsupervised discretization, Supervised discretization Data transformations PCA and variants Exercises</p>
6	<p>Introduction To Machine Learning: Linear Regression Learn to implement linear regression and predict continuous data values Classification Understand and implement algorithms like K-NN*, Naive Bayes and Logistic Regression Clustering Learn how to create segments based on similarities using K-Means and Hierarchical clustering</p>
7	<p>Big Data Analytics: Introduction to Big Data And Hadoop: Understand the basic concepts of Big Data and Hadoop as processing platforms for Big Data Managing Big Data: Learn and Use Hadoop Ecosystem tools for data ingestion, extraction and management. Hadoop ecosystem tools namely Sqoop, Hive will be covered in this Module</p>

Course Number	Course Name	L-T-P- Credits	Year of Introduction
502	Optimization Techniques	3L+1T+0P=4C4	2018
<p>Course Objective: Operations Research is a method of mathematically based analysis for providing a quantitative basis for analytical decisions in management. It provides different techniques based on logic and mathematics, and hence form the backbone of computer science.</p>			
<p>Expected Outcome : This module helps to introduce students to use quantitative methods and techniques for effective decisions–making model formulation and applications that are used in solving business decision problems.</p>			
<p>References (Books, Websites) : Books: Operations Research Theory and Applications by J. K. Sharma Operations Research: An Introduction (Pearson Publication, 8th edition) by H. A. Taha Web Resources : For video lectures refer to site – http://mech19.blogspot.in/2015/08/operation-research-video-lectures.html</p>			
<p>Suggested MOOC : Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com</p>			
Syllabus			
Unit	Contents		
1.	<p>Introduction to OR and Linear Programming Problem: Operation Research – Introduction, Models, Areas of Application, Basic terminologies in OR. Introduction to LPP Mathematical Formulation of L.P.P. Solution to LPP using – Graphical Method (Minimization and Maximization). Simplex Method – Concept of slack, surplus & artificial variables. Manual solutions of L.P.P. (up to 3 iterations). Solution using Big M method Duality and sensitivity Analysis in LPP Variations of LPP – Alternative optimal, Unbounded solutions & Infeasible solutions to be shown graphically & also by simplex method.</p>		

2.	<p>Transportation Definition and mathematical formulation of the transportation model. Finding initial basic feasible solution using – North-West Corner Rule Least cost method Vogel’s approximation method Checking for Optimality & obtaining of optimal solution using MODI method. Variations of Transportation Problem- Unbalanced problems Maximization. Degenerate Solutions</p>
3.	<p>Assignment Model Definition and mathematical formulation of Assignment Problem. Finding BFS and optimal solution for Assignment Problem using Hungarian method. Variations of Assignment Problem – Unbalanced problems Maximization Travelling Salesman Problem</p>
4.	<p>Network Analysis Introduction to project management and significance of PERT/CPM in project management. Components of network. Construction rules and precautions Network of phases of project. Critical Path Analysis (CPM): Calculating Earliest Time and Latest Time for events, finding critical path for project, Calculating floats (Total, free and independent float), Calculating probability for completion of projects.</p>
5.	<p>Simulation Introduction to simulation, types of simulation, advantages and disadvantages of simulation Steps in solving problem using simulation Monte Carlo Method for Simulation for – Inventory, Queuing, PERT, Investment Applications of Simulation</p>
6.	<p>Decision Theory and Decision Tree Introduction to terminologies in Decision Making (Decision alternatives, States of alternatives, payoff table) and steps in Decision Making. Types of Decision Environments – Decision making under Uncertainty & Decision making under Risk. Criteria for Decision making under uncertainty- Minimin or Maximax criteria, Miximin or Minimax Regret criterion, Laplace criterion, Hurwicz criterion. Criteria for Decision making under Risk- Expected Monetary Value criterion, Expected Opportunity Loss (E.O.L.)</p>

	Expected Value of Perfect Information (E.V.P.I.) Decision Tree introduction and building decision tree for Simple problems.
7.	Queuing Theory Introduction, structure of queuing System, Performance measures of a Queuing System, Probability Distributions in Queuing Systems of – Arrivals, Interarrival Times, Departures, Service times, Single Server Queuing Models, Multi Server Queuing Models

Course Number	Course Name	L-T-P- Credits	Year of Introduction
503	Software Project Management	3L+1T+0P=4C	2018
<p>Course Objective :</p> <p>To provide basic project management skills with a strong emphasis on issues and problems associated with delivering successful high quality IT projects.</p>			
<p>Expected Outcome :</p> <ul style="list-style-type: none"> • Evaluate project to develop scope of work, provide accurate cost estimation and to plan the various activities. • Identify resources required for a project and to produce a work plan and resources schedule 			
<p>References (Books, Websites etc) :</p> <ul style="list-style-type: none"> • Software Project Management – Bob and Huges • Software Project Management in Practice, Pankaj Jalote, Pearson Education,2002 • Software Engineering by Pressman • Basic of Software Management ,NIIT, Prentice-Hall India ,2004 • SOFTWARE REQUIREMENTS - MS project 2007 onward , CoStar 7 Onwards 			
Syllabus:			
Unit	Contents		
1	Introduction to project management - Project, project management, software project management, characteristics of project, how software projects are diff. Than other projects, Problems with software projects, All parties (stakeholders) involved in project. Role of Project Manager. Phases of project management life Cycle.		
2	Project Management Body of Knowledge – Project management institute, PMBOK. Role of PMBOK , Knowledge area's identified by PMBOK, Various certifications provided by PMBOK with their importance, Association for project management , project planning, importance.		
3	Project planning – Various plans to be prepared in SPM , Stepwise project planning , Importance of Project scheduling, project and activities, sequencing and scheduling activities , Importance of resource allocation, nature of resources , Identifying resource requirement , Scheduling resources , Work breakdown structure , Gantt chart, Network Planning models, formulating network model , Critical path analysis , PERT, Hands on experience with Microsoft Project.		
4	Cost and effort estimation – Where estimation done?, problem with over and under estimation , Cost to be considered during estimation, factors affecting cost estimation , cost estimation methods-non algorithmic , COCOMO model, Function point analysis model , Hands on experience with Costar or other estimation software's.		
5	Project risk management - The importance, top risk in projects , Classic mistakes, Elements of risk management – Risk		

	identification, risk analysis , Elements of risk management – Risk prioritization, risk control.
6	Managing Contract – Types of contract, Contract management and Acceptance Managing people and organizing teams - Organizational behavior, understanding behavior, Selecting Right person for right job, Motivation, Becoming a team and decision Making, Leadership styles, Organizational structures .
7	Software quality – Place of software quality in planning, Defining software quality and importance of it, Software quality measures, ISO standards, CMM standards, Quality Assurance document.

ELECTIVES

Elective Group:(01) Cloud Computing

Course Number	Course Name	L-T-P- Credit	Year of introduction
404-01-A	Virtualization	2L+1T+0P=3C	2018
Course Objective: Students will learn an an overview of the field of Cloud Computing Students will gain hands-on experience solving relevant problems through projects that will utilize existing public cloud tools. It is our objective that students will develop the skills needed to use cloud computing technique			
Course Outcome: student will be able to: <ul style="list-style-type: none">• Study core concept of cloud computing.• Study virtualization and outline its role in enabling the cloud computing system model.• Analyze various cloud computing models.			
References: <ul style="list-style-type: none">• “Virtualization” – A Manager’s Guide, By Dan Kusnetzky, O’reilley Publications,• “Virtualization for Dummies”, 1st Edition, Kindle Edition, by Bernard Golden.			
Suggested MOOC : Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com			
Unit	Contents		
1	Overview Of Virtualization : Introduction to Virtualization, Virtualization Approaches, Virtualization for Server Consolidation and Containment, Hardware Support for Virtualization, Para-Virtualization, vmWare’s Virtualization Solutions		
2	Understanding Virtualization : The Roots of Virtualization, Making Better Use of Your Systems with Virtualization, Approaches to Virtualization, Understanding the Virtualization Ecosystem, Reasons to Invest in Virtualization Hardware.		
3	Hypervisor: What is Hypervisor, Type 1 Hypervisor, Type 2 Hypervisor, Types of Hardware Virtualization : Full Virtualization, Emulation Virtualization Para virtualization., Installing Hyper-V In Windows Server 2012,		
4	Types Of Virtualization : Server Virtualization, Client & Desktop Virtualization Services and Applications Virtualization, Network Virtualization, Storage Virtualization		
5	Tools For Virtualization: Virtualization with Xen, Virtualization with Bochs and QEMU, Virtualization with Lguest, Virtualization with KVM		
6	Virtualization For Businesses: Need for Virtualization in a Business, Implementation of Virtualization in a Business, Cost-Benefit Analysis of Virtualization,		
7	Openstack And Its Role In Virtualization : Understanding Openstack, nine Core key components of openstack. CASE STUDIES OF VIRTUALIZATION : Xen Hypervisor, OpenVZ Hypervisor, MS Virtual Server 2005 R2, Oracle VM		

Elective Group :(01) Cloud Computing

Course Number	Course Name	L-T-P- Credit	Year of introduction
405-01-B	Cloud Computing Concepts	2L+1T+0P=4C	2018
Course Objective: Students will learn an an overview of the field of Cloud Computing Students will gain hands-on experience solving relevant problems through projects that will utilize existing public cloud tools. It is our objective that students will develop the skills needed to use cloud computing technique.			
Course Outcome: student will be able to: <ul style="list-style-type: none"> • Study core concept of cloud computing. • Study cloud application with various service providers services • Analyze various cloud computing models. 			
References: <ul style="list-style-type: none"> • Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010 • Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011 			
Suggested MOOC : Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Unit	Contents		
1	Cloud Computing Fundamentals: Definition of Cloud Computing , private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public Vs private clouds		
2	Virtualization And Cloud Computing: Role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications, Visualizing Virtualization, Managing Virtualization, Taking Virtualization into the Cloud		
3	Service Oriented Architecture And The Cloud : Defining Service Oriented Architecture, Understanding the Coupling, Implementation of Service Oriented Architecture (SOA), Understanding Services in the Cloud, Serving the Business with SOA and Cloud Computing		
4	Cloud Applications : Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages		
5	Management Of Cloud Services: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat)		
6	Application Development: Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.		
7	Cloud It Model: Analysis of Case Studies when deciding to adopt cloud computing architecture. How to decide if the cloud is right for your requirements. Cloud based service, applications and development platform deployment so as to improve the total cost of ownership (TCO)		

Elective Group :(01) Cloud Computing

Course Number	Course Name	L-T-P-Credit	Year of Introduction
504-01-C	Cloud Solutions	2L+1T+0P=3C	2018
Course Objective: Students will learn different cloud solutions available.			
Course Outcome: student will be able <ul style="list-style-type: none"> • Design their cloud solution for organization. • Implement the cloud solutions. And • Analyze various cloud computing models. 			
Reference Books: <ul style="list-style-type: none"> • “AWS System Administration: Best Practices for Sysadmins in the Amazon Cloud” by <u>Mike Ryan</u> , <u>Federico Lucifredi</u> . • “Expert AWS Development: Efficiently develop, deploy, and manage your enterprise apps on the Amazon Web Services platform” Kindle Edition, by <u>Atul Mistry</u>. • “VMware vSphere 6.5” Cookbook, 3rd Edition Kindle Edition 			
Suggested MOOC : Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com			
Unit	Contents		
1	Coriolis Technologies : About Coriolis Technologies, storage, virtualization, security, The Colama suite of products, benefits of colama suite, Virtualization of Computer Laboratories, Colama Powered Virtual Computer Laboratory		
2	vmWare : what is VmWare, Virtualization with Vmware, VmWare Products, Data Center and Cloud Infrastructure, Networking and Security, SDDC Platform, Storage and Availability, The vmWare Approach to the Cloud, vmWare vSphere 4, Server Consolidation and Containment		
3	Microsoft : Exploring Platform as a Service, Putting Platform as a Service Pedestal		
4	Microsoft : Integrated Lifecycle Platform, Anchored Lifecycle Platform as a Service Enabling Technologies as a Platform		
5	Google : Google App Engine, Details of Google app engine.		
6	Amazon : Infrastructure as a Service, Tracing IaaS to ISP, Amazon EC2		
7	Other Solutions : Infrastructure as a Service, Other IaaS Companies, IaaS-Enabling Technology, Issues related to Trust in Cloud, Infrastructure as a Service in a Business Organization		

Elective Group: Cloud Computing

Course Number	Course Name	L-T-P-Credit	Year of introduction
505-01-D	Cloud solutions	2L+1T+0P=3C	2018
Course Objective: Students will learn how to use Amazon web service portal and its services			
Course Outcome: Student will be able. Design their cloud solution using AWS. Implement the cloud solutions Using AWS. Practice of AWS applications			
Reference Books: <ul style="list-style-type: none"> • “AWS System Administration: Best Practices for Sysadmins in the Amazon Cloud” by Mike Ryan , Federico Lucifredi. , • “Expert AWS Development: Efficiently develop, deploy, and manage your enterprise apps on the Amazon Web Services platform” Kindle Edition, by <u>Atul Mistry</u>. 			
Suggested MOOC : Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com			
1	Getting Started with Amazon Cloud : Introduction to AWS, AWS history, AWS Infrastructure, AWS ecosystem, Setting up AWS accounts Evaluating Service Level Agreements (SLA) Various AWS Services AWS Management Console The AWS CLI		
2	Identity Access Management (IAM) : Introduction to IAM, IAM users and their access, IAM roles and their permission Active Directory Federation Web Identity, Federation IAM Best Practices. Assignment: Configuring IAM users, groups and policies, AWS CLI/SDK access to manage services using Credentials and Roles lab. Programming, management console and storage on AWS Basic Understanding APIs - AWS programming interfaces, Web services, AWS URL naming, Matching interfaces and services, Elastic block store - Simple storage service, Glacier - Content delivery platforms		
3	Elastic Load Balancing & Auto Scaling : Components and types of load balancing Auto scaling and its benefits Life cycle of auto scaling Components and policies of auto scaling Assignment - Configure Load Balancer, Auto scaling as per utilization in different situations		
4	Amazon EC2 : EC2 Overview Amazon Machine Images(AMI) AMI creation Security groups Key pairs Assigning elastic IP address Elastic IP v/s Public IP Bootstrap Scripts Overview of Amazon EBS , Various login ways from different OS, putty and putty keygen use, Assigning EIP, AMI assignment, Creating and restoring snapshot, snapshot to AMI, EC2 Bootstrapping, Cloudformation & CloudWatch assignments.		
5	Amazon Simple Storage Service(S3) : Introduction to S3 Creating an S3 bucket S3 Version Control S3 Lifecycle Management & Glacier S3 Uploading & Downloading S3 durability & redundancy Cloud front overview Create a CDN Security & Encryption Storage Gateway Import & Export using Snowball Cross region replication Static website using S3 Assignment - Creating S3 bucket, S3 ACL, S3 permissions, hosting static website on S3, Cross region replication assignment, S3 lifecycle assignment		
6	Database Services: Database overview Amazon Relational Database Service (RDS) AMI databases Amazon Redshift DynamoDB Amazon ElastiCache AWS Database Migration Service(DMS) Amazon Aurora Assignment - Creating RDS instance, DB backups, RDS Read Replica		
7	AWS identity services, security and compliance Users, groups,and roles: Understanding credentials, Security policies, IAM abilities and limitations, AWS physical security - AWS compliance initiatives, Understanding public/private keys, Other AWS security capabilities.		

Elective Group: (02) Data Analytics

Course Number	Course Name	L-T-P- Credits	Year of Introduction
404-02-A	Algorithms For Advanced Analytics	2L+1T+0P = 3C	2018
Prerequisite: Knowledge in basic analytical algorithms			
Course Objective :			
<ol style="list-style-type: none"> 1. Learn concepts and techniques and how to find useful knowledge. 2. Understanding of the topics that can create an ideal analytic environment that is better suited to the challenges of today's analytics demands. 3. Harness the power of high performance computing architectures and data mining, text analytics, and machine learning algorithms. 			
Expected Outcome :			
At the end of the course a student should be able: This course gives a comprehensive coverage of algorithms specially meant for analyzing data at an in-depth level. Decision trees, Support Vector machines and Neural networks are considered to be highly effective in analyzing complex data.			
References (Books, Websites etc) :			
<ol style="list-style-type: none"> 1. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Publishers, 3rd ed, 2010. 2. Lior Rokach and Oded Maimon, “Data Mining and Knowledge Discovery Handbook”, Springer, 2nd edition, 2010. 3. Ronen Feldman and James Sanger, “The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”, Cambridge University Press, 2006. 4. Vojislav Kecman, “Learning and Soft Computing”, MIT Press, 2010. 5. Jared Dean, “Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners”, Wiley India Private Limited, 2014. 			
Suggested MOOC: Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus:			
Unit	Contents		
1	Predictive Analytics: Predictive modeling and Analysis - Regression Analysis, Multicollinearity , Correlation analysis, Rank correlation coefficient, Multiple correlation, Least square, Curve fitting and goodness of fit.		
2	Classification Algorithms: Issues regarding classification and prediction, Bayesian Classification, Classification by back propagation, Classification based on concepts from association rule mining, Other Classification Methods, Classification accuracy.		
3	Decision Trees: Introduction to Decision trees - Classification by decision tree induction – Various types of pruning methods – Comparison of pruning methods – Issues in decision trees – Decision Tree Inducers – Decision Tree extensions.		
4	Text Analytics: Introduction, Core text mining operations, Preprocessing techniques, Categorization, Clustering, Information extraction, Probabilistic models for information extraction, Text mining applications.		
5	Support Vector Machines: Learning and Soft Computing: Rationale, Motivations, Needs, Basics: Examples of Applications in Diverse Fields, Basic Tools of Soft Computing: Neural Networks, Fuzzy Logic Systems, and Support Vector Machines,		
6	Computing: Basic Mathematics of Soft Computing, Learning and Statistical Approaches to Regression and Classification - Support Vector Machines - Risk Minimization Principles and the		

	Concept of Uniform Convergence, The VC Dimension, Structural Risk Minimization, Support Vector Machine Algorithms.
7	Neural Networks: Single-Layer Networks: The Perception, The Adaptive Linear Neuron (Adaline) and the Least Mean Square Algorithm - Multilayer Perceptions: The Error Back propagation Algorithm – The Generalized Delta Rule, Heuristics or Practical Aspects of the Error Back propagation Algorithm.

Elective Group:(02) Data Analytics

Course Number	Course Name	L-T-P- Credits	Year of Introduction
405-02-B	Machine Learning Techniques	2L+1T+0P = 3C	2018
Prerequisite: Knowledge in basic analytical algorithms.			
Course Objective : <ul style="list-style-type: none"> • To introduce students to the basic concepts and techniques of Machine Learning. • To have a thorough understanding of the Supervised and Unsupervised learning techniques. • To study the various probability based learning techniques. • To understand graphical models of machine learning algorithms. 			
Expected Outcome : Upon completion of this course, the students will be able to: <ul style="list-style-type: none"> • Distinguish between, supervised, unsupervised and semi-supervised learning • Apply the appropriate machine learning strategy for any given problem • Suggest supervised, unsupervised or semi-supervised learning algorithms for any given • Problem Design systems that uses the appropriate graph models of machine learning • Modify existing machine learning algorithms to improve classification efficiency 			
References (Books, Websites etc) : <ul style="list-style-type: none"> • Ethem Alpaydin, —Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press. • Jason Bell, —Machine learning – Hands on for Developers and Technical Professionals, First Edition, Wiley. • Peter Flach, —Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press. • Stephen Marsland, —Machine Learning – An Algorithmic Perspective , Second Ed., Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,. • Tom M Mitchell, —Machine Learning , First Edition, McGraw Hill Education. 			
Suggested MOOC: Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus:			
Unit	Contents		
1	Introduction: Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.		
2	Linear Models : Multi-layer Perception – Going Forwards – Going Backwards: Back Propagation Error – Multilayer Perception in Practice – Examples of using the MLP – Overview – Deriving Back Propagation – Radial Basis Functions and Spines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.		
3	Tree And Probabilistic Models: Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities.		
4	Basic Statistics: Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map		
5	Dimensionality Reduction And Evolutionary Models : Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares		

6	Optimization: Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.
7	Graphical Models : Markov Chain Monte Carlo Methods, Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

Elective Group:(02) Data Analytics

Course Number	Course Name	L-T-P- Credits	Year of Introduction
504-02-C	Weka	2L+1T+0P = 3C	2018
Prerequisite: Knowledge in basic analytical algorithms			
Course Objective : <ul style="list-style-type: none"> • To introduce the basic concepts and various techniques of machine learning • To give idea about supervised and unsupervised learning techniques. • The purpose of machine learning is to discover patterns in your data and then make predictions based on those often, complex patterns to answer business questions, and help solve problems. Machine learning helps analyze your data and identify patterns 			
Expected Outcome : <ul style="list-style-type: none"> • After Completion of this course students will be able to understand the difference between supervised, unsupervised and semi supervised learning. • To apply appropriate machine learning algorithms using weka tool to given problem. • To as per data result requirement to modify existing algorithms for better result. 			
References (Books, Websites etc) : <ul style="list-style-type: none"> • Data Mining Concepts and Techniques By Jiawei Han & Micheline Kamber • Data Mining: Practical Machine Learning Tools and Techniques (The Morgan Kaufmann Series in Data Management Systems) 3rd Edition, Kindle Edition • An Introduction to Machine Learning Hardcover by Miroslav Kubat (Author) • An Introduction to weka: Machine Learning in Java by Giorgio Siron 			
Suggested MOOC: Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus:			
Unit	Contents		
1	Machine Learning and Weka basics: Overview about machine learning concepts, Data Cleaning by weka, Major issues of machine learning, core algorithm type, Overview about weka basics , File type, Experimenter and explorer. Bayesian network, neural network, Trees, Rule concepts		
2	Creating Dataset for Weka: Creating ARFF, CSV file format, Data Types, Class enumeration, filtering algorithms based on feature type in weka, Interpreting and refining results		
3	Linear Model: Classification concepts, how classification works in data sample, Classifying data in weka using classification rules. Concept of Regression, Choose algorithm for regression. Multilayer perception –forward and backward propagation. Support vector machine classification and regression for predictive analysis		
4	Decision Tree and model: Decision tree concepts, Attribute selection measures, visual mining for decision tree, rule based classification, Ensemble methods- Bagging and boosting, Random forest method, cross validation concept.		
5	Dimensionality Reduction And Evolutionary Models: Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis ,parametric and nonparametric method		
6	Cluster Analysis using different methods: Concept of cluster analysis, methods of clustering with constraints, dimensional reduction methods, biclustering, probabilistic model based clustering.		
7	Knowledge Data Flow: Create knowledge data flow on data sample, Analysis data flow, Interpret results with weka , Generate the rules on the basis of result.		

Elective Group:(02) Data Analytics

Course Number	Course Name	L-T-P- Credits	Year of Introduction
505-02-D	Statistical Computing	2L+1T+0P = 3C	2018
Course Objective : The main objective of this course is to acquaint students with some basic concepts in Statistics. They will be introduced to some elementary statistical methods of analysis of data.			
Expected Outcome : <ul style="list-style-type: none"> • To compute various measures of central tendency, dispersion, skewness and kurtosis. • To analyze data pertaining to attributes and to interpret the results. • To compute the correlation coefficient for bivariate data and interpret it. • To fit linear, quadratic and exponential curves to the bivariate data to investigate relation between two variables. • To fit linear regression model to the bivariate data • They are able to construct predicate model. 			
References (Books, Websites etc) : Fundamentals of Statistics , S.C.Gupta, Seventh Edition ,Himalaya Publishing House			
Suggested MOOC: Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus:			
Unit	Contents		
1	Random Number: Concept of random number generator, congruential method of generating uniform variate, Generation of Binomial, Poisson, Geometric, Negative Binomial & Multinomial variate. Proofs of related results. Generation of continuous random variables covering Exponential, Normal, Gamma, Chi-square, Bivariate exponential, Bivariate Normal distributions, and mixture of distributions.		
2	R – Language: Introduction to R, elementary programming, application to data analysis, Descriptive statistics, Fitting of Distributions, Cross Tables, Correlations and Regression, Hypothesis Testing, ANOVA.		
3	Simulation Technique: Concept of Simulation, advantage, Disadvantage, Phases of Simulation ,Application of Simulation Models, Types of Simulation Models, Random Numbers, Monte-Carlo(Computer) Simulation Procedure for Monto-Carlo Simulation.		
4	Queuing and Forecasting: Concept of Queuing, Queuing models, Forecasting techniques, forecasting methods: Subjective For casting, Structural and Economic Model, Determination Models, Moving Average, Regression Average, Least Square Method of curve fitting.		
5	Statistical Decision Theory: Concept, state of Nature or Events, Payoff table, Opportunity Loss, Decision Making Environment, Decision Making Under Certainty, Decision Making Under Uncertainty, Maximax, Minimin, Minimax, Laplace Criterion, Hurwicz ,EMV,EOL, EVIP, Bayes Decision rule		
6	Statistical Applications: Regression analysis, Paired test, T-test,F-test, Chi test, Decisions Tree, Probability distributions		
7	Programming in C++: Concept of OOP, Data types, Variables, Statements, Expressions, Control structures, Looping, Functions, Pointers. Programming for problems based on all Unit .		

Elective Group: (03) Linux Environment

Course Number	Course Name	L-T-P- Credit	Year of introduction
404-03-A	Linux Desktop Environment and Shell Programming	2L+1T+0P=3C	2018
Course Objective: The purpose of this course is to have understanding of Linux operating system and environment			
Expected Outcome : At the end of the course a student should be able: To use Linux operating system for configuring the environment.			
Textbook: <ul style="list-style-type: none"> ▪ Red Hat Linux Bible: Fedora and Enterprise Edition - by Christopher Negus ▪ UNIX Concepts and Applications - by Sumitabha Das 			
Suggested MOOC : Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Unit	Contents		
1	Using Shell Interface: 12 Introduction to Linux 13 Internal and external commands 14 General purpose utilities 15 Navigating the file system 16 Handling ordinary files Using GUI Environments: 17 GNOME desktop environment 18 KDE desktop environment		
2	Using open source office suite 19 Word processor application 20 Spreadsheet application 21 Presentation application 22 Desktop database application Using the Internet 23 World wide web 24 FTP 25 Telnet		
3	Using Multimedia 26 Graphics 27 Audio 28 Video		
4	Introduction to shell 29 Introduction to 'bash' shell 30 Redirection 31 Pipes 32 Tees 33 Command substitution 34 Introduction to other shells: Korn shell, C Shell etc. Shell environment 35 Shell variables 36 Handling the command line arguments 37 Login scripts 38 Terminal characteristics 39 Aliases		
5	Text editors 40 'vi' editor 41 'emacs' editor		

6	<p>Shell commands</p> <ul style="list-style-type: none">42 General purpose utilities43 File management44 Process management45 Communication management <p>Regular expressions</p> <ul style="list-style-type: none">46 Pattern matching47 Wild cards48 Regular expressions49 Utilities: grep, egrep, fgrep etc. <p>Filters</p> <ul style="list-style-type: none">50 Introduction to filters51 Utilities: pr, head, tail, cut, paste, sort, uniq, nl, tr etc.
7	<p>Shell scripting</p> <ul style="list-style-type: none">52 Introduction to shell scripting53 Programming constructs54 Mathematical operators55 Logical operators56 String manipulation57 Interactive scripts58 Handling command line arguments

Elective Group :(03) Linux Environment

Course Number	Course Name	L-T-P- Credit	Year of introduction
405-03-B	Linux System Administration	2L+1T+0P=3C	2018
Course Objective: The purpose of this course is to have understanding of Linux operating system and system administration			
Expected Outcome : At the end of the course a student should be able: 1.To use Linux administration for user management and security.			
Reference books : UNIX Concepts and Applications - by Sumitabha Das			
Suggested MOOC : Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Unit No	Contents		
1	Linux installation: 59 Introduction to Linux distributions 60 Normal installation		
2	Linux installation: 61 Dual boot installation 62 Virtual installation 63 Troubleshooting an installation		
3.	Understanding system administration: 64 Introduction to the routine activities in system administration 65 Shell commands for system administration 66 Administrative tools 67 Managing file systems and disk space		
4.	Setting up and supporting users: 68 Managing user accounts 69 Providing support to the users		
5.	Automating system tasks: 70 Aut System initialization 71 System startup and shutdown 72 Scheduling system tasks omating system tasks:		
6.	Backing up and restoring files: 73 Backup and restore strategy 74 Backup and restore tools		
7.	Computer security issues: 75 Password protection 76 Firewalls		

Elective Group :(03) Linux Environment

Course Number	Course Name	L-T-P- Credit	Year of introduction
504-03-C	Linux Network Administration	2L+1T+0P=3C	2018
Course Objective: The purpose of this course is to have understanding of Linux operating system and Network administration.			
Expected Outcome : At the end of the course a student should be able 1. To use Linux administration for creation of server and management.			
Reference books : 1. Linux Administration : A Beginner's Guide, Shah, TMH 2.LINUX: The Complete Reference, Petersen, TMH 3.LINUX Network Administrator's Guide, Kirch,SPD/O'REILLY			
Suggested MOOC : Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Unit No	Contents		
1	Setup And Manage a Local Area Network: Basic Networking, Introduction to networking, OSI Model,IP addressing (IPV4, IPV6) & LAN establishment with Linux , Configuring internet in Linux through broadband, dial-up, data card & through mobile (gprs).		
2	Setup And Manage Proxy Server : Basics of proxy services, Configuring proxy services, Creating ACL's for controlling access to internet, SQUID: Proxy server setup, Blocking Websites, content filtering, Bandwidth Management		
3.	Setup And Manage FILE Server: NFS: network file sharing & resource sharing across Linux environment. YUM server: Setting up local YUM, FTP YUM, HTTP YUM, EPEL, REMI & RPMForge like YUM configuration, DHCP:Dynamic Host Configuration Protocol setting up, Allocating IP, Subnet mask, default gateway and hostname, communication with DNS and other protocols.		
4.	Setup And Manage FTP Server: Basics of File Transfer Protocol., Configuring vsftpd for anonymous ftp service. FTP:Setting up file transfer protocol,user management for FTP,hands on with ftp clients, FTP security (file,user, host,network based). Remote Services:SSH, Telnet & VNC (remote access services) with security(file,user, host,network based). Network Installation: NFS, HTTP, FTP, Kickstart, TFTP SAMBA: Linux to window data sharing along with security (file,user, host,network based) & managing SAMA graphically. Ticket Server: (OS-Ticket & ORTS) installing, configuring and managing.		
5.	Setup And Manage Web Server : Basics of Web Services, Introduction to Apache, Configuring Apache for main site, Configuring Apache for multiple sites using IP-based, port based and name-based, Web Server: Apache installation, configuring dedicated server, shared server, user based authentication, load balancing and apache tuning. NIS, LDAP: (user's liberty to sit into remote machine) MAIL Server: knowing MUA,MTA& MDA, setting up and configuring POSTFIX,PO3s v/sIMAPs, Squirrel mail, accessing via Outlook, Thunderbird and evolution. Multi/virtual domain management, email security. Postfix Administration.		
6.	Setup And Manage boot Server : What is booting and boot process of Linux?, Init Process or Run levels		
7.	Setup And Manage DNS Server : Basics of Internet, Basics of DNS and BIND 9, Configuring DNS primary server, DNS:master DNS, slave DNS with forward & reverse zone, one DNS resolving multiple domain, dynamic DNS etc		

Elective Group: (03) Linux Environment

Course Number	Course Name	L-T-P- Credit	Year of introduction
505-03-D	Linux Internals and Network	2L+1T+0P=3C	2018
Course Objective: <ul style="list-style-type: none"> • To get acquainted with Linux kernel and system calls • To get knowledge about Process and managing process life. • Build deeper view IPC and its applications. • To make able to use Signals and threads and using thread library. • Make them understanding network communications and using API to write socket programs. • Make them understand about scheduling and memory management. 			
Expected Outcome : At the end of the course a student should be able: 1.To use programming for kernel management and networking.			
Suggested MOOC : Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Unit No	Contents		
1	Introduction Architecture of Linux, User and Kernel Space, Introduction to System Calls, System Calls in Detail, trace – Tracing system calls.		
2	Process management Introduction to Process and process attributes, process vs. Program, Process States, Creating Process, Process termination, process commands Special case of processes.		
3.	Inter Process Communication Introduction to IPC, Pipe, FIFO, Shared Memory, Advantages and Disadvantages of various IPC mechanisms, Application of IPC		
4.	Working with Signals and Threads Introduction to Signals, Default disposition of Signals, Handling the Signals, Signal Related Functions Introduction to Threads, Creating Thread, Data handling with Thread , Types of Threads – Thread Attributes, Thread Cancellation , Threads vs. Process		
5.	Thread and Process Synchronization Threads and resources management, Race condition in multi-threaded applications, writing thread safe code, Mutex, POSIX Semaphores, Usage of Binary semaphores and Mutex Race condition in multi-process applications, Limitations of shared memory, Semaphore Implementation.		
6.	Linux Networking OSI and TCP/IP models, Addressing in TCP/IP, IPv4 and IPv6 differences, TCP three-way handshake, Network packet analysis in Linux, Networking commands in Linux, Using socket API to implement client server communication, Working with TCP and UDP sockets, Synchronous I/O		
7.	Process and Memory Management Need of Process scheduler, scheduling algorithms, Memory Management Unit (MMU) introduction, Concept of Virtual memory, using Paging & Page fault, other MMU concepts: Relocation, Protection, Sharing, Logical and physical organization.		

Elective Group:(04) Open Source Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
404-04-A	Python	2L+1T+0P=3C	2018
Course Objective : Main objective of this paper is to learn functioning of various commands of Python language. Also study the practical applications in the field of Software development.			
Expected Outcome : At the end of this course, student should be able to understand <ul style="list-style-type: none">• Basic familiarity with Python• Development tools used for the Python programming• Implementation of OO concepts.			
References (Books, Websites etc) : A Python Book: Beginning Python, Advanced Python, and Python Exercises : Dave Kuhlman			
Suggested MOOC : Swayam			
Course Plan			
Unit	Contents		
1	Introduction to Python: Etc, Lexical matters : Lines, Comments, Names and tokens, Blocks and indentation, Doc strings, Program structure, Operators, Code evaluation		
2	Built-in Data types : Numeric types, Tuples and lists, Strings, 1 The new string. format method, Unicode strings, Dictionaries, Files, Other built-in Types, The None value/type, Boolean values, Sets and frozen sets		
3	Statements: Assignment statement, import statement, print statement, if: elif: else: statement, for: statement., while: statement., continue and break statements, try: except: statement., raise statement..., with: statement, del, case statement		
4	Functions, Modules, Packages, and Debugging Functions : The def statement Returning values, Parameters, Arguments, Local variables, Other things to know about functions, Global variables and the global statement, Doc strings for functions, Decorators for functions, lambda Iterators and generators, Modules, Doc strings for modules, Packages		
5	Classes: A simple class, Defining methods, The constructor, Member variables, Calling methods, Adding inheritance, Class variables, Class methods and static methods, Properties, Interfaces, New style Classes, Doc strings for classes, Private members		
6	Extending and embedding Python: Introduction and concepts, Extension modules, SWIG, Pyrex, SWIG vs. Pyrex, Cython, Extension types, Extension classes		
7	GUI Applications: Introduction PyGtk, EasyGUI, Guidance on Packages and Modules, End Matter,		

Elective Group:(04) Open Source Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
405-04-B	Perl Scripting	2L+1T+0P=3C	2018
Course Objective : To introduce the basic concepts of Perl Programming and write, modify, and run simple Perl scripts and study working with files and using perl as an object oriented language			
Expected Outcome : At the end of this course, student should be able to understand <ul style="list-style-type: none"> • The syntax and semantics of the Perl language • how to develop and implement various types of programs in the Perl language • various forms of data representation and structures supported by the Perl language • the appropriate applications of the Perl language 			
References (Books, Websites etc) : <ul style="list-style-type: none"> • Mastering Perl : Brian, O'Reilly • www.tutorialspoint.com/perl/index.htm 			
Suggested MOOC : Swayam			
Course Plan			
Unit	Contents		
1	Perl – Introduction : What is Perl? Perl features , Perl – Syntax Overview, Perl – Data Types , Numeric Literals String Literals , Perl – Variables , Creating Variables, Perl– Scalars, Scalar Operations Perl – Arrays Perl – Hashes		
2	Control Flow and Looping Statement: if statement ,if else statement, if elsif else statement, unless statement, switch statement, The ? : Operator Perl – Loops : while loop , until loop for loop, For each loop do while loop nested loops, next statement, last statement, continue statement, redo statement, go to statement, Infinite Loop		
3	Perl – Operators : What is an Operator? Perl Arithmetic Operators, Perl Equality Operators, Perl Assignment Operators, Perl Bitwise Operators, Perl Logical Operators, Quote-like Operators Perl – Date and Time, GMT Time Format, Date & Time, Epoch time, POSIX Function strftime()		
4	Perl – Subroutines : Define and Call a Subroutine, Passing Arguments to a Subroutine, Passing Lists to Subroutines, Passing Hashes to Subroutines, Returning Value from a Subroutine, Private Variables in a Subroutine, Temporary Values via local(), State Variables via state() Subroutine, Call Context Perl – References : Create References Dereferencing Circular References, References to Functions Perl – Formats Define a Format Using the Format, Define a Report Header Number of Lines on a Page, Define a Report Footer		
5	Perl – File I/O : Opening and Closing Files, Open Function, Sysopen Function, Close Function, The Operator getc Function, read Function, print Function, Copying Files Renaming a file, Deleting an Existing File Positioning inside a File Perl – Directories : Display all the Files, Create new Directory, Remove a directory, Change a Directory		
6	Perl – Regular Expressions : Pattern Matching, Match Operator Match Operator Modifiers Matching Only Once Regular Expression Variables. The Substitution Operator Substitution Operator Modifiers. The Translation Operator Translation Operator Modifiers More Complex Regular Expressions Matching Boundaries Selecting Alternatives Grouping Matching. The \G Assertion Regular-expression Examples		

7

Introduction to Object Oriented Programming in Perl :

Object Basics, Defining a Class Creating and Using Objects, Defining Methods, Inheritance Method Overriding , Default Auto loading, Destructors and Garbage Collection, Object Oriented Perl Example

Elective Group:(04) Open Source Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
504-04-C	PHP	2L+1T+0P=3C	2018
Course Objective: To make students able to design and develop the web based applications and systems.			
Expected Outcome: After completion of this course students will able to develop static and dynamic web applications through Word press, PHP and Joomla.			
References (Books, Websites etc) : <ul style="list-style-type: none"> • PHP and MySQL Web Development- Welling Thomson 4th Ed.(Pearson) • Teach Yourself PHP, MySQL and Apache by Julie C. Meloni (Pearson) 			
Suggested MOOC : SWAYAM			
Unit	Contents		
1	Introduction To PHP: Installing and configuring PHP, Building blocks of PHP: PHP tags, variables, data types, operators, expressions, constants, Control Structures: conditional statements, loops, switch statement		
2	Working With Functions And Arrays: Working with functions: What is a function? Function declaration and definition, Calling function, user-defined functions, variable scope, Working with arrays: Creating, sorting and reordering arrays, PHP classes. Working with strings, dates and time: Formatting, investigating and manipulating strings with PHP, using date and time functions in PHP, Working with forms: Creating a simple input form		
3	Working With Files: Saving data, storing and retrieving Bob's order, processing files, opening file, writing to a file, closing a file, reading from a file, uses other useful file functions.		
4	Working With Cookies And Sessions: Working with cookies: Introducing cookies, setting and deleting cookies with PHP Working with session: starting a session, working with session variables, passing session IDs in the query string, destroying sessions and unsetting variables, using sessions		
5	MYSQL: Creating web database: Using MySQL monitor, logging into MySQL, creating databases and users, setting users and privileges, column data types Working with MySQL database: Inserting data into database, retrieving data from the database, retrieving data with specific criteria, retrieving data from multiple tables, retrieving data in particular order, grouping and aggregate data, using sub queries, updating records, deleting records from databases, dropping table and database		
6	Accessing My-SQL Database From Web With PHP : Web database architecture Querying database from the web: checking and filtering input data, setting up connection, Choosing database to use, querying database, retrieving the query result, disconnecting from the database.		
7	WORDPRESS AND JOOMLA: WORDPRESS - Word press Theme, Integration Adding Pages and posts Manage Widgets, Plug - In Project in Word press JOOMLA – Joomla Installation, Template Integration, Adding content (articles management) Adding content (articles management) Project in Joomla		

Elective Group:(04) Open Source Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
505-04-D	Ruby	2L-1T-0P=3C	2018
<p>Course Objective: Main objective of this paper is to learn, object-oriented programming with Ruby, Rails fundamentals and how to create basic online applications. How to work with HTML controls, use models in Rails applications, and work with sessions. Details on working with databases and creating, editing and deleting database records, Methods for handling cookies and filters and for caching pages.</p>			
<p>Expected Outcome: At the end of this course, student should be able to understand</p> <ul style="list-style-type: none"> • Programming experience in an object-oriented language. • Basic familiarity with HTML important for Rails project. 			
<p>References (Books, Websites etc.):</p> <ul style="list-style-type: none"> • Programming Ruby: The Pragmatic Programmers' Guide, Second Edition • Agile Web Development with Rails, Third Edition • www.webtechlearning.com 			
<p>Suggested MOOC : SWAYAM</p>			
Unit	Contents		
1.	<p>Introduction to Ruby : Creating a first web application, getting started with Ruby, Checking the ruby documentation, working with numbers in ruby, working with strings in ruby.</p>		
2.	<p>Variables and Constants in Ruby : Storing data in variables, creating constants, interpolating variables in Double-Quoted strings, reading text on the command line, creating symbols in ruby, working with operators, Handling operator precedence, working with Arrays, using Two Array Indices, working with Hashes, working with ranges.</p>		
3.	<p>Conditional Loops, Methods and Blocks: If Statement, Using the case statement, using loops, creating and calling a method, making use of Scope, working with Blocks</p>		
4.	<p>Classes: Encapsulation, creating a class, creating an object, basing one class to another,</p>		
5.	<p>Objects: Understanding Ruby's object Access, overriding method, creating class variables, creating class methods, creating Modules, creating Mixins</p>		
6.	<p>Rails: Putting Ruby to Rails, introducing Model View Controller Architecture, giving the view something to do, mixing ruby code and HTML inside the view, passing data from an action to a view, escaping sensitive text, adding a second action.</p>		
7.	<p>Building Simple Rails Applications : Accessing data the user provides, using rails shortcuts for HTML controls, working with models, tying controls to models, initializing data in controls, storing data in sessions</p>		

Elective Group: (05) Mobile Computing Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
404-05-A	HTML 5	2L+1T+0P= 4C	2018-19
Objectives:			
Expected Outcome :			
References (Books, Websites etc) :			
Suggested MOOC : Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus:			
Introduction to HTML	<ul style="list-style-type: none"> ▪ History and Evolution of HTML Types ▪ Introduction to HTML5 ▪ Differences between types of HTML(HTML,XHTML,HTML5) 		
Features of HTML5	<ul style="list-style-type: none"> ▪ Detection of HTML5 Support ▪ Modernizr: An HTML5 Detection Library ▪ Canvas ▪ Canvas Text ▪ Video ▪ Video Formats ▪ Local Storage ▪ Web Workers ▪ Offline Web Applications ▪ Geolocation ▪ Input Types ▪ Placeholder Text ▪ Form Autofocus ▪ Microdata 		
Elements of HTML5	<ul style="list-style-type: none"> ▪ The Doctype ▪ The Root Element ▪ The <head> Element ▪ New Semantic Elements in HTML5 ▪ Headers ▪ Articles ▪ Dates and Times ▪ Navigation ▪ Footers 		
HTML Media	<ul style="list-style-type: none"> ▪ Adding Media to Web Page ▪ Video Tag and its attributes ▪ Audio Tag and its attributes 		
HTML Graphics	<ul style="list-style-type: none"> ▪ Introduction to Canvas ▪ Simple Shapes ▪ Canvas Coordinates ▪ Paths ▪ Text ▪ Gradients ▪ Images 		
Geolocation	<ul style="list-style-type: none"> ▪ Geolocation API ▪ Handling Errors ▪ geo.js Library 		
Local Storage for Web Applications	<ul style="list-style-type: none"> ▪ Evolution of Local Storage ▪ Introduction to HTML5 Storage 		

Offline Web Application	<ul style="list-style-type: none"> ▪ Introduction to Offline Web application ▪ The Cache Manifest
Web Forms	<ul style="list-style-type: none"> ▪ Introduction to Web Forms and its elements ▪ Placeholder Text ▪ Autofocus Field ▪ e-Mail Addresses ▪ Web Addresses ▪ Numbers as Spinboxes ▪ Numbers as Sliders ▪ Date Pickers ▪ Search Boxes ▪ Color Pickers
CSS3	<ul style="list-style-type: none"> ▪ Introduction ▪ Basic designs (Color, Background, Padding, Margin, Height/Width) ▪ CSS Box-Model ▪ CSS Positions ▪ CSS Selectors ▪ Advanced CSS <ul style="list-style-type: none"> • Media queries • Transitions • Animations • Flex-box • Gradients
Miscellaneous	Introduction to CSS Preprocessors ,SASS & LESS, CSS framework, Bootstrap, Cross browser compatible CSS

Elective Group: (05) Mobile Computing Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
405-05-B	JavaScript Programming	2L+1T+0P= 4C	2018-19
Objectives:			
Expected Outcome :			
References (Books, Websites etc) :			
Suggested MOOC : Please refer these websites for MOOC's: NPTEL / Swayam ,www.edx.com , www.coursera.com			
Syllabus:			
Introduction to Javascript	<ul style="list-style-type: none"> ▪ JavaScript Overview ▪ JavaScript Programming Basics 		
Variables and Operators	<ul style="list-style-type: none"> ▪ Variables and Data Types ▪ Operators ▪ Array 		
Control Statements	<ul style="list-style-type: none"> ▪ Controlling the Flow: JavaScript Control Statements 		
Functions	<ul style="list-style-type: none"> ▪ Functions 		
The Window Object	<ul style="list-style-type: none"> ▪ The Window Object ▪ Dialog Boxes ▪ Window functions 		
The Document Object	<ul style="list-style-type: none"> ▪ The Document Object ▪ Writing to Documents ▪ Document related functions 		
Forms and Forms-based Data	<ul style="list-style-type: none"> ▪ The Form Object ▪ Working With Form Elements and Their Properties ▪ Event related with form 		
Form Validation	<ul style="list-style-type: none"> ▪ Form Validation: A Process ▪ Testing Data ▪ Preparing Data for Validation and Reporting Results ▪ Validating Non-text Form Objects 		
Frames	<ul style="list-style-type: none"> ▪ HTML Frames Review ▪ Scripting for Frames 		
The String and RegExp Objects	<ul style="list-style-type: none"> ▪ The String Object ▪ Properties and methods of String Object ▪ Using String Object Methods to Correct Data Entry Errors ▪ The RegExp Object 		
Dates and Math	<ul style="list-style-type: none"> ▪ The Date Object ▪ Properties and methods of Date Object ▪ The Math Object ▪ Properties and methods of Math Object 		
Animation	<ul style="list-style-type: none"> ▪ Frequently used Animation function ▪ Manual and Automated animation. 		
AJAX	<ul style="list-style-type: none"> ▪ Introduction to AJAX ▪ Interacting with the Web Server using XMLHttpRequest Object ▪ Need of Web server ▪ Need of JSON ▪ RESTful API with JSON 		
JS Frameworks & Libraries	<ul style="list-style-type: none"> ▪ jQuery <ul style="list-style-type: none"> • Intro • Effects and animations • DOM/HTML Updates • jQuery and Ajax 		

Elective Group: (05) Mobile Computing Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
504-05-C	Android	2L+1T+0P= 4C	2018-19
Objectives:			
Expected Outcome :			
References (Books, Websites etc) :			
Suggested MOOC : Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus:			
Introduction to Android	<ul style="list-style-type: none"> ▪ Evolution of Android ▪ Advantages of Android ▪ SDK Tools for Android 		
Overview of Android Platform	<ul style="list-style-type: none"> ▪ Android Development IDE Understand the Working of Android ▪ The Android Application Framework ▪ Screen Layout Design ▪ User Interface Design ▪ Introduction to Graphics and Animation Design ▪ Interactivity ▪ Introduction to Content Providers ▪ Intent and Intent Filters 		
Setting up the Android Development Environment	<ul style="list-style-type: none"> ▪ Installing Android Development Environment ▪ Updating the Android SDK ▪ Setting up AVDs and Smartphone Connections 		
Introduction to the Android Software Development Platform	<ul style="list-style-type: none"> ▪ Understanding Java SE and Dalvik Machine ▪ The Directory Structure of an Android Project ▪ Android XML ▪ Android Application Resources ▪ Launching an Android Application ▪ Creating first Hello Application 		
Overview of Android Framework	<ul style="list-style-type: none"> ▪ Overview of Object Oriented Programming ▪ Overview of XML ▪ The Anatomy of an Android Application ▪ Components of an Android Application ▪ Android Intent Objects ▪ Android Manifest XML 		
Screen Layout Design	<ul style="list-style-type: none"> ▪ Android View Hierarchies ▪ Activity Lifecycle ▪ Defining Screen Layouts (Screen size, pixel density) 		
User Interface Design	<ul style="list-style-type: none"> ▪ Using Common UI Elements ▪ Using Menus in Android ▪ Adding Dialogs(Date picker, Time picker, Custom Dialog, Alert Dialog) 		
Introduction to Graphics Resources	<ul style="list-style-type: none"> ▪ Introduction to Drawables ▪ Using Bitmap Images ▪ Using Transitions ▪ Creating 9-Patch Custom Scalable Images ▪ Playing Video in Android Apps 		
Handling User Interface Events	<ul style="list-style-type: none"> ▪ An Overview of UI Events ▪ Handling onClick Events for all Views ▪ Android Touch-screen Events: onTouch ▪ Touch-screen's Right-Click Equivalent: onLongClick ▪ Keyboard Event Listeners: onKeyUp, onKeyDown 		

	<ul style="list-style-type: none"> ▪ Context Menus: onCreateContextMenu ▪ Controlling the Focus
Understanding Content Providers	<ul style="list-style-type: none"> ▪ An Overview of Android Content Providers ▪ Defining a Content Provider ▪ Working with a Database
Intents and Intent Filters	<ul style="list-style-type: none"> ▪ Understanding the Intents ▪ Android Intent Messaging via Intent Objects ▪ Intent Resolution ▪ Using Intents with Activities ▪ Android Services ▪ Using Intents with Broadcast Receivers
Bars and Views	<ul style="list-style-type: none"> ▪ Action Bar, Toolbar, Navigation Drawer, TextView, EditText, Button, WebView, ImageView ,ListView etc

Elective Group: (05) Mobile Computing Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
505-05-D	Hybrid App Development	2L+1T+0P= 4C	2018-19
Objectives:			
Expected Outcome :			
References (Books, Websites etc) :			
Suggested MOOC : Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus:			
Introduction to Mobile App Development (Warm-up)	<ul style="list-style-type: none"> ▪ Introduction ▪ Introduction Types of mobile apps <ul style="list-style-type: none"> • Web Apps • Native Apps • Hybrid Apps ▪ Intro to Web Apps <ul style="list-style-type: none"> • Concept • Single Page Apps • Progressive Web Apps • Accelerated Mobile Pages • PWA vs AMP ▪ Intro to Native Apps <ul style="list-style-type: none"> • Concept • Pros and Cons ▪ Intro to Hybrid Apps <ul style="list-style-type: none"> • Concept • Pros and Cons • Native vs Hybrid apps ▪ Web Or Native Or Hybrid? 		
Getting Started with React Native (Getting in action)	<ul style="list-style-type: none"> ▪ Introduction to React Native ▪ Installing dependencies <ul style="list-style-type: none"> ▪ Installing Node, Python2, JDK ▪ The React Native CLI ▪ Android development environment ▪ Creating a new application ▪ Preparing the Android device ▪ Running your React Native application 		
More Details (Diving deep)	<ul style="list-style-type: none"> ▪ Native modules ▪ Components <ul style="list-style-type: none"> ▪ ActivityIndicator, Button, Image, ListView, Modal, ProgressBarAndroid, RefreshControl, ScrollView, Slider, StatusBar, Switch, Text, TextInput, ToolbarAndroid, WebView ▪ API's <ul style="list-style-type: none"> ▪ Alert, AppState, CameraRoll, Clipboard, DatePickerAndroid, Keyboard, PermissionsAndroid, Settings, Share, StyleSheet, TimePickerAndroid, ToastAndroid, Vibration 		

Elective Group: (06) Dot Net Technologies

Course Number	Course Name	L-T-P-Credits	Year of Introduction
404-06-A	C# Programming	2L+1T+0P=4C	2018
Course Objective : The objectives of the course is to introduce Object Oriented Programming using C#, make student to use C# for implementing object- oriented concepts. Make student to create, compile and run object-oriented C# programs using Visual Studio.			
Expected Outcome : At the end of this course, student should be able to <ul style="list-style-type: none"> • Design classes using inheritance and polymorphism. • Design interfaces, abstract and concrete classes. • Design Console Based Applications. • Design applications using event driven programming. • Write basic LINQ programs. 			
References (Books, Websites etc) : <ul style="list-style-type: none"> • C#: The Complete Reference, McGraw-Hill Osborne Media- Herbert Schildt. • C # Programming- Wrox publication. • Programming in C# -A Primer. E. Balaguruswamy. 			
Suggested MOOC : 1) Coursera (www.coursera.org) 2) mymooc (www.my-mooc.com) 3) Class Central (www.class-central.com) 4) edX (www.edx.org) 5) Mooc List (www.mooc-list.com)			
Syllabus:			
Unit No.	Contents		
1.	Introduction to C# The Dot Net Framework, CLR, CLS, CTS, MSIL, Managed Code, Programming Features of C#, Compile and Execution of C# Program, Keywords in C#, Namespaces, Data Types, Declaration and Initialization of Variables, Operators, Type Conversions, If, If...else, switch, The '?' Operator, The while Loop, The do....while Loop, The for Loop, 'var' Variable.		
2.	Methods and Arrays: Define Method, Declaring and Calling a Method, Passing Method Parameters (Pass By Value, Pass by Reference), Method Overloading, Define Array, One Dimensional Array (Declaration, Creation and Initialization), Two Dimensional Array, Multidimensional Array, ArrayList Class, Jagged Array, Manipulating Strings, String Methods, Regular Expressions, foreach Loop.		
3.	Class and Objects: Basic Principles of OOP, Define a Class, Member Access Modifiers, Constructors, Types of Constructors (Default Constructor, Overloaded Constructor, Static Constructor, Private Constructor and Copy Constructor), Destructors, 'this' Reference, Constant Members, Properties, Auto Implemented Properties, Object Initializer, Collection Initializer, Anonymous Types, Extension Methods, Partial Class, Partial Methods, Indexers.		
4.	Inheritance and Polymorphism Define Inheritance, Types of Inheritance, Method Overriding, Abstract Class, Abstract Methods, Sealed Class and Methods, Define Polymorphism, Static Polymorphism: Function Overloading Operator Overloading, Overloadable and Nonoverloadable Operators, Dynamic Polymorphism, Defining Interface, Extending interface, Interface and Inheritance, Explicit Interface.		

5.	Errors and Exception Handling Types of Errors, Exceptions, Syntax for Exceptions Handling Code, Multiple catch Statements, finally Statement, Nested try Blocks, Throwing Our Own Exception.
6.	Delegates, Events and LINQ Define Delegate, Singlecast Delegate, Multicast Delegate, Events, Declaring Events, Introduction to LINQ, LINQ Query Operators, LINQ-SQL, LINQ-Objects, LINQ-Dataset.
7.	Professional Techniques for C# Runtime Type Identification, Reflection, Attributes, Generics, Generic Structure, Unsafe code, Iterators Examples.

Elective Group: (06) Dot Net Technologies

Course Number	Course Name	L-T-P-Credits	Year of Introduction
405-06--B	ASP.Net with C#	3L+1T+0P=4C	2018
Course Objective: The objective of the course is to introduce web programming using C#, make student to use C# for implementing different controls of ASP.Net. To introduce designing and interacting tools such CSS and JavaScript.			
Expected Outcome : At the end of this course, student should be able to <ul style="list-style-type: none"> • Design websites using C# platform • Work with various controls of ASP.Net • Work with different states, cookies, themes etc. • Work with data access controls using different databases. 			
References (Books, Websites etc) : <ul style="list-style-type: none"> • ASP.Net: The Complete Reference, Matthew MacDonald • Professional ASP.Net (4/4.5) in C #- Wrox publication. 			
Suggested MOOC: 1) Coursera (www.coursera.org) 2) mymooc (www.my-mooc.com) 3) Class Central (www.class-central.com) 4) edX (www.edx.org) 5) Mooc List (www.mooc-list.com)			
Syllabus			
Unit	Contents		
1.	Introduction of ASP.Net: Introduction to ASP.Net, ASP.Net Architecture, ASP.Net Page Life Cycle, Page Life Cycle Events, ASP.Net Directives.		
2.	Using ASP.Net Rich, Validation, and Navigation Controls: FileUpload Control, Calendar Control, AdRotator Control, MultiView Control, and Wizard Control Examples. RegularFieldValidator, RegularExpressionValidator, RangeValidator, CompareValidator, CustomValidator, ValidationSummary, Menu, SiteMapPath, TreeView Control.		
3.	Master Pages, CSS, and JavaScript: Working With Master Pages, Nested Master Pages, CSS Overview, Adding Style Sheets into, Web Pages, Editing Styles, Applying Styles to Master Pages, Applying Styles to Web Page, JavaScript Overview, Adding JavaScript files into ASP.Net, Editing JavaScript Files, Applying JavaScripts to Master Pages, Applying JavaScripts to Web Page.		
4.	State Management: View State, Hidden Field, Session State, Application State, QueryString, HttpContext, Cookies, Caching, Types of Caching		
5.	Personalization and Security: Configuration Overview, Concept of Theme, Applying Themes, Types of Themes- Page Theme and Global Theme, Skins, Security in ASP.Net, Authentication and Authorization Membership and Roles.		
6.	Data Access in ASP.Net: Data Source Controls, DataList, DataPager, GridView, DetailsView, FormView, Object Data Sources, ListView, DataPager, Repeater		
7.	Publishing and Testing Website: IIS, Configuration of IIS, Setting Application Pool, Publish Website, Testing Website.		

Elective Group: (06) Dot Net Technologies

Course Number	Course Name	L-T-P-Credits	Year of Introduction
504-06-C	C# Windows Programming	3L+1T+0P=4C	2018
Course Objective: The objective of the course is to introduce windows programming using C#, make student to use C# for implementing basic and advanced controls of windows applications. To introduce ADO.Net, XML, and Report Wizards with windows applications.			
Expected Outcome : At the end of this course, student should be able to <ul style="list-style-type: none"> • Design Windows forms applications • Work with advanced controls of windows forms application • Work with ADO.Net classes and XML • Generate reports 			
References (Books, Websites etc) : <ul style="list-style-type: none"> • C#: The Complete Reference, McGraw-Hill Osborne Media- Herbert Schildt. • C # Programming- Wrox publication. • Programming in C# -A Primer. E. Balaguruswamy. 			
Suggested MOOC: <ol style="list-style-type: none"> 1) Coursera (www.coursera.org) 2) mymooc (www.my-mooc.com) 3) Class Central (www.class-central.com) 4) edX (www.edx.org) 5) Mooc List (www.mooc-list.com) 			
Syllabus			
Unit	Contents		
1	Introduction to Windows Programming: Overview of Windows Forms, Windows Forms Class Hierarchy, Windows of Visual Studio IDE (Start Page, Menu Bar, Solution Explorer Window, Properties Window, Server Explorer Window, Toolbox, Forms Designer), Dynamic Controls.		
2	Working with Windows Forms Controls: Properties, Events and Examples of: Button, Label, LinkLabel, TextBox, RichTextBox, ListBox, ListView, ComboBox, RadioButton, CheckBox, CheckedListBox, DateTimePicker, PictureBox, Timer, ProgressBar, TrackBar, HScrollBar, VScrollBar		
3	Dialog Controls: ColorDialog, FolderBrowserDialog, FontDialog, OpenFileDialog, SaveFileDialog. Examples.		
4	Menus, MDI and Containers: ContextMenuStrip, MenuStrip, StatusStrip, ToolStrip, SDI and MDI, Visual Inheritance, GroupBox, Panel, TreeView, SplitContainer, TabControl Examples.		
5	File Handling using C#: FileStream, BinaryReader, BinaryWriter, StreamReader, StreamWriter, StringReader, StringWriter, DirectoryInfo, FileInfo Examples.		
6	Data Access and Data Binding: ADO.NET Overview, .NET Data Providers, ADO.Net Objects, Connections, Commands, Data Adapters, Data Readers , Data Sets , Data Tables , Data Views , Data Binding, Reports.		
7	XML with Windows Forms Applications: XML file, Create XML file, Write data into XML, Read Data from XML file using C#. Update, Filter, and Delete data form XML File.		

Elective Group: (06) Dot Net Technologies

Course Number	Course Name	L-T-P-Credits	Year of Introduction
505-06--D	Advanced ASP.Net with MVC	2L+1T+0P=3C	2018
Course Objective: The objective of the course is to introduce advanced ASP.Net using C#, make student to use C# for implementing advanced features of ASP.Net such JQuery and MVC framework.			
Expected Outcome : At the end of this course, student should be able to <ul style="list-style-type: none"> • Work with web parts and AJAX controls. • Create and consume web services using C#. • Work with WPF and WCF. • Work with JQuery and MVC framework. 			
References (Books, Websites etc) : <ul style="list-style-type: none"> • ASP.Net: The Complete Reference, Matthew MacDonald • Professional ASP.Net (4/4.5) in C #- Wrox publication. • <i>Microsoft ASP.NET Step by Step (Microsoft Press)</i> - G. Andrew Duthrie 			
Suggested MOOC: 1) Coursera (www.coursera.org) 2) mymooc (www.my-mooc.com) 3) Class Central (www.class-central.com) 4) edX (www.edx.org) 5) Moco List (www.mooc-list.com)			
Syllabus			
Unit	Contents		
1	ASP.Net Web Parts: Introduction, Advantages of Web Parts, WebPartsManager, CatalogPart, PageCatalogPart, EditorPart, WebPartZone, EditorZone, CatalogZone Controls.		
2	ASP.Net AJAX: AJAX control toolkit, Building a ASP.NET Page with Ajax ScriptManager Control, UpdatePanel Control, UpdateProgress Control, Timer Control.		
3	ASP.Net Web Services: Introduction to Web services, Creating Web Services, Setting the Web Service Attributes, Test and Run Web Services, Consuming Web Services.		
4	Windows Presentation Foundation: Overview of WPF, Creating Simple Program in WPF, WPF-Command line, WPF-Data Binding, WPF-Resources, and WPF-Templates.		
5	Windows Communication Foundation: Overview of WCF, WCF-architecture, Creating WCF Service, Hosting WCF Service, Types of Hosting WCF Service, Consuming WCF Services. Difference between WCF and Web Services.		
6	JQuery: Introduction to JQuery, Features, JQuery Selectors, Working of JQuery, JQuery UI Library, Document Ready Event, Events Handling, Effects Methods.		
7	Working with MVC: Introduction to .Net MVC Framework, MVC Framework Features, MVC Architecture, MVC Components, MVC Application Folders, Configuration files- global.asax, packages.config, web.config, Working with Views, Working with Controls.		

Elective Group: (07) Net Centric Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
404-07-A	HTML5	3L+1T+0P=4C	2018
Course Objective: <ul style="list-style-type: none"> • Understand the Concepts of HTML 5 & the Applications of HTML 5 to Website Development. • Design and Develop Websites for various Business Applications. • Check information inputted into a Database and validate it. 			
Pre-requisites: Basic concepts of Languages and HTML tags with functions.			
Expected Outcome : After going through this course a student should be able to understand : <ul style="list-style-type: none"> • The Learners will be able to write HTML 5 code for developing website applications. • The websites developed can be uploaded and implemented for the business areas . 			
References (Books, Websites etc.): <ul style="list-style-type: none"> ○ Bruce Lawson, Remy Sharp –Introducing HTML 5.0 –Google Books 2010. ○ Jeffrey Zeldman and Jeremy Keith “HTML 5 for Webdesigners –Google Books-2010. ○ Book by Brian Albers, Frank Salim, and Peter Lubbers “Pro HTML 5.0 Programming ○ Christopher Murphy, Divya Manian, and Richard Clark: Beginning HTML5 and CSS3.2012 			
Suggested MOOC: Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus			
Unit	Contents		
1	Introduction to HTML: MIME Types, Standards for the Internet, Evolution of HTML, Introduction to XHTML, Introduction to Working Group, W3C		
2	Features of HTML5: Detection of HTML5 Support, Modernizr: An HTML5 Detection Library, Canvas, Canvas , Text, Video, Video Formats, Local Storage, Web Workers, Offline Web Applications, Geolocation, Input Types, Placeholder Text, Form Autofocus, Microdata		
3	Elements of HTML5: The Doctype, The Root Element, The <head> Element, New Semantic Elements in HTML5, Handling of Unknown Elements by the Browsers, Headers, Articles, Dates and Times, Navigation, Footers		
4	Drawing Surface: Introduction to Canvas, Simple Shapes, Canvas Coordinates, Paths, Text, Gradients, Images		
5	Video on the web Video Containers, Video Codecs, Audio Codecs		
6	Geolocation and Local Storage for Web Applications Geolocation API, Handling Errors, geo.js Library, Evolution of Local Storage, Introduction to HTML5 Storage		
7	Web Forms and Offline Web Application Introduction to Web Forms, Placeholder Text, Autofocus Field, e-Mail, Addresses, Web Addresses, Numbers as Spinboxes, Numbers as Sliders, Date Pickers, Search Boxes, Color Pickers, Introduction to Offline Web application, The Cache Manifest		

Elective Group: (07) Net Centric Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
405-07-B	JavaScript Programming	2L+1T+0P=3C	2018
<p>Course Objective:</p> <ul style="list-style-type: none"> • Understand the JavaScript language & the Document Object Model. • Alter, show, hide and move objects on a web page. • Check information inputted into a form. • Javascript allows programming to be performed without server interaction. • Javascript can respond to events, such as button clicks. • Javascript can validate data before sending out a request. • Javascript can adjust an HTML document for special effects 			
<p>Pre-requisites: Computer. Pre-requisite / Target Audience: An intermediate knowledge on Java and Advanced Java Technology.</p>			
<p>Expected Outcome : After going through this course a student should be able to understand :</p> <ul style="list-style-type: none"> • The Learners will be able to write Java Script code for developing website applications. • The websites developed can be uploaded and implemented for the business areas in java Script Code. 			
<p>References (Books, Websites etc.):</p> <ol style="list-style-type: none"> 1. Danny Goodman Michael Morrison Paul Novitski Tia GustaffRayl, “Javascript Bible” , 7th Edition Wiley India Pvt Ltd. 2. Kogent Learning Solutions Inc, “Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX , “ Dreamtech Press. 3. Fritz Schneider, Thomas Powell , “JavaScript : The Complete Reference”, 2nd Ed.(TM 			
<p>Suggested MOOC: Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com</p>			
Syllabus			
Unit	Contents		
1	Introduction to Javascript: JavaScript Overview , Comparison between Java, JavaScript & VB Script, JavaScript Programming Basics		
2	Variables and Operators: Variables and Data Types , Using Variables and Literals , Operators		
3	Introduction to Objects, Methods and Events Objects, Methods, and Events, Events and Program Flow, Jumping Right In, Running Scripts.		
4	Control Statements Controlling the Flow: JavaScript Control Statements		
5	Understanding Functions Built in Functions , Standard Date and Time Functions		
6	<p>The Window Object The Window Object, Dialog Boxes , Status Bar Messages , Window Manipulations</p> <p>The Document Object The Document Object, Writing to Documents, Dynamic Documents</p>		

	Dates and Math Objects The Date Object , Using and Manipulating Dates , The Math Object , Doing Math with JavaScript
7	Frames , Forms and Forms-based Data and Form Validation . HTML Frames Review, Scripting for Frames, The Form Object , Working With Form , Elements and Their Properties, Form Validation: A Process , Testing Data , Preparing Data for Validation and Reporting Results , Validating Non-text Form Objects The String and RegExp Objects The String Object , Using String Object Methods to Correct Data Entry Errors , Creating Dynamic Effects with Substring Methods , The RegExp Object

Elective Group: (07) Net Centric Technologies

Course Number	Course Name	L-T-P- Credits	Year of Introduction
504-07-C	AJAX Programming	2L+1T+0P=3C	2018
Course Objective: <ul style="list-style-type: none"> • Understand the Concepts of AJAX Programming & the Applications of AJAX to Website Development. • Design and Develop Websites for various Business Applications using AJAX Programming. • Check information and handle database in websites. 			
Pre-requisites: Computer. Pre-requisite / Target Audience: An intermediate knowledge on Programming Languages and its structure for developing professional websites.			
Expected Outcome : After going through this course a student should be able to understand : <ul style="list-style-type: none"> • Concepts of AJAX Programming and its Applications to website Development. • Design and develop professional web applications in the business domain. 			
References (Books, Websites etc.): <ul style="list-style-type: none"> ○ Ajax: The Definitive Guide: Interactive Applications by Anthony T. Holdener -2014. ○ Kris Hadlock “Ajax for Web Developers Amazon Books 2012. ○ Ajax: The Complete Reference by Thomas A. Powell-Amazon Books 2013 ○ Website :- https://www.amazon.com/Learn-JavaScript-Ajax-w3Schools-W3Schools/dp/0470611944/ 			
Suggested MOOC: Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus			
Unit	Contents		
1	Introduction to AJAX: Introduction to Web Architecture, Traditional Web Communication Processes and Technologies , Introduction to AJAX		
2	Interacting with the Web Server using XMLHttpRequest Object: Introduction to Interaction with Web Server, Create an XMLHttpRequest Object, Interact with the Web Server		
3	Working with PHP and AJAX: Introduction to PHP , Process Client Requests , Accessing Files Using PHP		
4	Manipulating XML Data: Basics of XML , Create an XML Document Using DOM , Retrieve Data from XML		
5	Working with XSLT and AJAX: Basics of XSLT , Transform Responses Using XSLT		
6	Working with JSON: Introduction to JSON Format, Create Data in JSON Format , Implement JSON on the Server Side		
7	Using Frameworks in AJAX: Understand AJAX Frameworks , Use Prototype and Script.aculo.us , Use jQuery Applying Basic AJAX Techniques Download Images Using AJAX, Auto-Populate Select Boxes Implementing Security and Accessibility in AJAX Applications Create Secure AJAX Applications , Create Accessible Rich Internet Applications		

Elective Group: (07) Net Centric Technologies

Course Number	Course Name	L-T-P-Credits	Year of Introduction
505-07-D	Web Services	2L+1T+0P=4C	2018
Course Objective: <ul style="list-style-type: none"> Understand the Concepts of Web services the Applications for Website Development. Design and Develop Websites for various Business Applications using XML Check and Validate information inputted into a Database and validate it. 			
Pre-requisites: Computer. Pre-requisite / Target Audience: An intermediate knowledge on XML			
Expected Outcome : After going through this course a student should be able to understand : <ul style="list-style-type: none"> Learners will be able to write code in XML and Understand the basic concepts of web services . The programmes written can be implemented for business applications using XML and apply web services in different areas of business . 			
References (Books, Websites etc.): <ul style="list-style-type: none"> Book by Ethan Cerami Web Services Essentials Amazon Books 2014. Book by Eric Newcomer Understanding Web Services: XML, WSDL, SOAP, and UDDI- Amazon Books 2013. Erik T. Ray “Learning XML Google Books 2015. Website :- https://www.w3schools.com/xml/default.asp 			
Suggested MOOC: Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus			
Unit	Contents		
1	XML Technology Family: Introduction to XML, Advantages of XML, EDI, Databases for Web, XML Based Standards, Structuring with Schemas: DTD, XMLSchemas , XML Processing: DOM, SAX , Presentation Technologies: XSL, XFORMS, XHTML Transformation: XSLT, XLINK, XPATH, XQuery		
2	Architecting Web Services: Business Motivations for Web Services , Technical Motivations for Web Services, Limitations of CORBA and DCOM, Service Oriented Architecture (SOA), Architecting Web Services, Implementation View: Web Services Technology Stack, Logical view: Composition of Web Services, Deployment View: From Application Server to Peer to Peer, Process View: Web Service Lifecycle		
3	Building Blocks of Web Services: Transport Protocols for Web Services, Messaging with Web Services, Protocols for Web Services, SOAP, WSDL, UDDI		
4	Creation of Web Services: Web Services using .Net, Web Services using J2EE		
5	Implementing XML in e-Business: B2B Applications, B2C Applications, Different types of B2B Interactions, Components of e-Business XML Systems, ebXML, RosettaNet, Applied XML in Vertical Industry: Web Services for Mobile Devices		
6	XML Content Management: Semantic Web, Role of Metadata in Web Content, Resource Description Framework: RDF Schema, Architecture of Semantic Web, Content Management Workflow: XLANG, WSFL		
7	Security in Web Services: Meeting Security Requirements, XML Encryption, Client / Server Security Issues		

Elective Group:(08) Information Systems

Course Number	Course Name	L-T-P- Credits	Year of Introduction
404-08-A	Enterprise Resource Planning	2L+1T+0P=3C	2018
Course Objective: The objective of the course is to enable students in learning basic concepts of Enterprise Resource Planning so that they can understand how to use the organizational resources effectively.			
Pre-requisites: Knowledge of Business Process , Business Functions and MIS			
Expected Outcome : After going through this course a student should be able to understand : <ul style="list-style-type: none"> • Will be able to understand the concepts of ERP. • Can be able to design and develop ERP systems for Business applications . • Implementation of ERP for various areas of Interest in Business Organizations 			
References (Books, Websites etc.): 1. Alexis Leon, ERP (Demystified Hrs), 5/E, Tata McGraw-Hill, 2006. 2. David L Olson, Managerial Issues of Enterprise Resource Planning Systems,(MGH) Int.Ed.2006. 3 Sinha; Enterprise Resource Planning , Cengage Learning, New Delhi,			
Suggested MOOC: Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus			
Unit	Contents		
1	Introduction to ERP: Overview of ERP, MRP, MRPII and Evolution of ERP, Integrated Management Systems, Reasons for the growth of ERP , Business Modeling , Integrated Data Model , ERP Market.		
2	ERP Technologies: Business Process Re-engineering (BPR), BPR Process, Clean Slate Re-engineering Technology Enabled Re-engineering , Myths regarding BPR , Business Intelligence Systems-Data Mining, Data Warehousing, On-Line Analytical Processing (OLAP), Supply Chain Management, Best Practices in ERP.		
3	ERP Modules : (a) Finance, Accounting Systems, Manufacturing and Production Systems, Sales and Distribution Systems, Human Resource Systems, Plant Maintenance System, Materials Management System, Quality Management System (b) ERP System Options and Selection (c) ERP proposal Evaluation.		
4	ERP Implementation: Implementation Strategy Options, Features of Successful ERP Implementation, Strategies to Attain Success		
5	Maintenance and Benefits of ERP: Improvement opportunities , IT Maintenance, Business Needs , Business Priority , Maintenance Cost , User Training, ERP Solutions		
6	ERP & Information System: Reduction of Lead Time, On-Time Shipment , Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance , Increased Flexibility , Reduced Quality Costs, Improved Information Accuracy and Decision Making Capabilities.		
7	Case Studies on ERP : ERP for Finance , Manufacturing , Supply Chain and Quality Management for any Business Organization		

Elective Group:(08) Information Systems

Course Number	Course Name	L-T-P-Credits	Year of Introduction
405-08-B	E-Commerce	2L+1T+0P=3C	2018
<p>Course Objective: This course explores the basics of working with internet including WWW, Email, Browsing, Chatting etc., and understands the potential of secured electronic transactions, E-mail security and electronic publishing.</p>			
<p>Pre-requisites: Knowledge of Internet and Internet Technologies , Programming knowledge and Network Technology basics.</p>			
<p>Expected Outcome :</p> <ul style="list-style-type: none"> • Will be able to understand the concepts of E-Commerce. • Can be able to design and develop E-Commerce facilities for Business applications . Implementation of E-Commerce Websites for Business firms. 			
<p>References (Books, Websites etc.):</p> <ol style="list-style-type: none"> 1. Web Commerce Technology Handbook, byDanielMinoli, EmmaMinoli,(MGH) 2. Frontiers of electroni commerece by Galgotia. 3. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley. 4. E-Commerce, S.Jaiswal – Galgotia. 5. E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang. 6. Electronic Commerce – Gary P.Schneider – Thomson. 7. E-Commerce -Business,Technology, Society, Kenneth C.Taudon, Carol Guyerico Traver. 			
<p>Suggested MOOC:Please refer these websites for MOOC's: NPTEL / Swayam www.edx.com www.coursera.com</p>			
Syllabus			
Unit	Contents		
1	<p>Introduction and Concept What is E-Commerce? Types of E-Commerce and Applications of E-Commerce, E-Commerce Basic Requirements, Internet and Concepts of Internet.</p>		
2	<p>Approaches to Safe Electronic Commerce: Secure Transport Protocols, Secure Transactions, Secure Electronic Payment Protocol (SEPP), Secure Electronic Transaction (SET), Certificates for authentication Security on web Servers and Enterprise Networks, Electronic Cash and Electronic Payment Schemes: Internet Monetary, Payment & Security Requirements. Payment and Purchase Order Process,On-line Electronic cash.</p>		
3	<p>Internet/Intranet Security Issues and Solutions: The need for Computer Security, Specific Intruder Approaches, Security Strategies, Security Tools, Encryption, Enterprise Networking and Access to the Internet, Antivirus Programs, Security Teams.</p>		
4	<p>Master Card/Visa Secure Electronic Transaction: Introduction, Business Requirements Concepts, payment Processing, E-Mail and Secure E-mail , Technologies for Electronic Commerce: Introduction, The Means of Distribution, A model for Message Handling, E-mail working, Multipurpose Internet Mail Extensions, Message Object Security Services, Comparisons of Security Methods, MIME and Related Facilities for EDI over the Internet.</p>		
5	<p>Internet Resources for E-Commerce Introduction, Technologies for web, Servers, Internet Tools Relevant to Commerce, Internet Applications for Commerce, Internet Charges, Internet Access and Architecture, Searching the Internet, Advertising on Internet: Issues and Technologies, Advertising on the Web, Marketing creating web site, Electronic Publishing Issues, Approaches and Technologies: EP and web based EP.</p>		

6	E-Commerce Website Development Website Development , Online Transactions and Payments , Security Issues in E-Commerce website
7	Case Studies on E-Commerce :- Amazon , Flip kart , Myantra

Elective Group:(08) Information Systems

Course Number	Course Name	L-T-P- Credits	Year of Introduction
504-08-C	Recommender System	2L+1T+0P=3C	2018
Course Objective:			
Pre-requisites: Knowledge about Business Organizations and its functions , Theory of Recommender Systems and Decision Making process .			
Expected Outcome : After going through this course a student should be able to understand : <ul style="list-style-type: none"> • Will be able to understand the concepts of Decision Making Process. • Can be able to design and develop Recommender for Business applications. • Implementation of Recommender System for various areas of Interest in Business Organizations . 			
References (Books, Websites etc.): <ol style="list-style-type: none"> 1. “Recommender systems An Introduction” by Dietmar Jannach, Markus Zanker, Alexzander Felfering, Gerhard friedrich by Cambridge university press 2011 2. recommender systems handbook [book] by francesco ricci, lior rokach, paul b. kantor in books 			
Suggested MOOC: Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus			
Unit	Contents		
1	Introduction to Basic Concepts: Collaborative Recommendation: User Based Nearest Neighbor recommendation, Item Based Nearest Neighbor recommendation, model based and pre-processing based approaches. Recent practical approaches and systems. Content based Recommendation: content representation and content similarity, similarity based retrieval, other text classification methods, Knowledge Based Recommendation: Knowledge representation and reasoning, interacting with constraint based recommenders, interacting with case based recommenders,		
2	Hybrid recommendation approaches: Opportunities for hybridization, Monolithic hybridization design, parallelized hybridization design, pipelined hybridization design,		
3	Evaluating recommender systems : General properties of Evaluation research, popular evaluation designs, evaluation on historical datasets, alternate evaluation design		
4	Recent developments: Attacks on collaborative recommender systems, Online consumer decision making		
5	Recommender systems and the next-generation web Recommendations in ubiquitous environments.		
6	Explanations in recommender systems Explanations in constraint-based recommenders, explanation in case based recommenders, explanation in collaborative filtering recommenders.		
7	Case studies on Recommender System.		

Elective Group:(08) Information Systems

Course Number	Course Name	L-T-P- Credits	Year of Introduction
505-08-D	Knowledge Management	2L+1T+0P=3C	2018
Course Objective: The objective of the course is to provide the basic skills of managing knowledge in organizations. Knowledge is an asset for retaining the competitive advantage of the organization. This course develops the capabilities of towards managing students to manage knowledge in organizations.			
Pre-requisites: Knowledge about Information System and MIS with Implementation of MIS			
Expected Outcome : After going through this course a student should be able to understand : <ul style="list-style-type: none"> • Will be able to understand the concepts of Knowledge and knowledge management . • Can be able to design and develop Knowledge management systems for Business applications. • Implementation of KM to various areas of Interest in Business Organizations . 			
References (Books, Websites etc.): <ol style="list-style-type: none"> 1. Madhukar Shukla:Competing Through Knowledge-Building a learning Organisation(Response Books, New Delhi. 2. Tiwana, The Knowledge Management Toolkit: Practical Techniques for building a Knowledge Management Systmes, 2/e, Pearson Edu. 3. Honey Cutt : “Knowledge Management Strategies”, PHI, New Delhi. 4. A wad, KM, Pearson Edn, 2007. 5. Barnes, Knowledge Management Systems, 1/e, Thomson 2006. 6. Ikudiro Nonka & Hirotaka Takeuchi, “ The Knowledge – Creating Company”, Oxford University Press, 			
Suggested MOOC: Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com			
Syllabus			
Unit	Contents		
1	Introduction: Definition, Scope and Significance of Knowledge Management , Difficulties of Knowledge Management, Techniques of KM – Implementation of KM, Organizational knowledge, Characteristics and Components of Organizational Knowledge		
2	Drivers of knowledge Management: Pillars of knowledge Management, KM framework , Supply Chain of KM , Formulation of KM strategy.		
3	Technology and KM: Technology components of KM – IT & KM ,Ecommerce and KM		
4	Total Quality Management and KM: TQM and KM , Bench marking and KM.		
5	Implementation of KM: Discussion on Roadblocks to success, Implementing a KM programme , Critical Success Factors in KM , Implementation of KM		
6	KM and Organizational Restructuring: The Mystique of Learning, Organization:- Outcomes of learning, Learning and Change – Innovation, continuous Improvements, Corporate Transformation.		
7	Case studies in Knowledge Management Knowledge management in Health Care, Knowledge Management in Human Resource Management		

Elective Group:(09) Internet Of Things

Course Number	Course Name	L-T-P- Credits	Year of Introduction
404-09-A	IoT Architecture And Protocols	2L+1T+0P=3C	2018
Course Objective: The purpose of this course is to impart knowledge on IoT Architecture and various protocols, study their implementations			
Expected Outcome : At the end of the course a student should be able: 1.To Understand the Architectural Overview of IoT 2. To Understand the IoT Reference Architecture and Real World Design Constraints 3. To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)			
References: 1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1 st Edition, Academic Press, 2014. 2. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM – MUMBAI 3. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer 46. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.htm			
Text Books: <ul style="list-style-type: none"> • Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118- 47347-4, Willy Publications • Vijay Madiseti and ArshdeepBahga, “Internet of Things (A Hands-onApproach)”, 1 st Edition, VPT, 2014. 			
Suggested MOOC: Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com			
Course Plan			
Unit	Contents		
1	IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management		
2	Architecture of IoT 1. Hardware 2. Software Reference Model and architecture, IoT reference Model - IoT Reference ArchitectureIntroduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.		
3	IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS (12 hours) PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15),		
4	WirelessHART,Z-Wave,Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP		
5	Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS)		
6	Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT		
7	SERVICE LAYER PROTOCOLS & SECURITY - Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer		

Elective Group: (09) Internet Of Things

Course Number	Course Name	L-T-P- Credits	Year of Introduction
405-09-B	Sensors and Fundamentals with Hands-on lab Node.js/Raspberry PI/Python	2L+1T+0P=3C	2018
Course Objective: The purpose of this course is to impart knowledge on IoT Architecture and various protocols, study their implementations			
Expected Outcome : At the end of the course a student should be able: 1.To Understand the basics of Python and node js to interface with sensors			
REFERENCES: 1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1 st Edition, Academic Press, 2014. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.htm			
Text Books: <ul style="list-style-type: none"> • Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118- 47347-4, Willy Publications 			
Suggested MOOC : Please refer these websites for MOOC’s: NPTEL / Swayam ,www.edx.com, www.coursera.com			
Course Plan			
Unit	Contents		
1	Sensing and Measurements 0-5 Voltage Analog I/O Pulse Width Mode I2C Communication		
2	Sensor Types, Classification Visual, Fleet Tracking sensors Wiring Basics		
3	Practical :Working with Temperature, Humidity, Light & Motion Detector, Promity Sensor		
4	Edge Devices & Gateway Devices With hands-on using Raspberry PI using Node.js/Python Introduction to Edge Devices Wired, Wireless Communications Serial Port/UART BLE/WIFI Introduction to Arduino [Serial port communication] Introduction to ESP32 [WIFI/BLE Device] (Micro Controller for Edge Devices) Hands-on using C [Arduino], Embedded JavaScript [ESP]		
5	Actuators and Controllers with Hands-on using Raspberry PI with Node.js/Python Actuators and Controllers Controllers Introduction Buzzer Relay Switches Servo Motors		
6	Gateway with Raspberry PI Gateway Introduction Needs for Gateway, Roles of Gateway Edge/Gateway Connectivity		
7	Raspberry PI, Single Board Linux Computer WIFI/BLE Communication with Edge Devices Hands on using Node.js/Java/C#/Python based on training needs		

Elective Group:(09) Internet Of Things

Course Number	Course Name	L-T-P- Credits	Year of Introduction
504-09-C	Internet Of Things: Sensing And Actuator Devices	2L+1T+0P=3C	2018
<p>Course Objective: The purpose of this course is to impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things, IoT applications and examples overview (building automation, transportation, healthcare, industry, etc.) with a focus on wearable electronics</p>			
<p>Expected Outcome : At the end of the course a student should be able:</p> <ol style="list-style-type: none"> 1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved 2. Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules 3. Market forecast for IoT devices with a focus on sensors 4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi 			
<p>References:</p> <ol style="list-style-type: none"> 1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024', Yole Développement Copyrights ,2014 2. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014 5. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014. <p>http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.htm</p> <p>Text Books:</p> <ul style="list-style-type: none"> • Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118- 47347-4, Willy Publications • Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on Approach)”, 1 st Edition, VPT, 2014. 			
<p>Suggested MOOC : Please refer these websites for MOOC’s: NPTEL / Swayam www.edx.com www.coursera.com</p>			
Course Plan			
Unit	Contents		
1	Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device		
2	SEVEN GENERATIONS OF IOT SENSORS TO APPEAR Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics– Polytronics Systems – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap		
3	TECHNOLOGICAL ANALYSIS - Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module		

4	IOT DEVELOPMENT EXAMPLES:ACOEM Eagle – EnOcean Push Button – NEST Sensor – Ninja Blocks - Focus on Wearable Electronics
5	- PREPARING IOT PROJECTS (9 hours) Creating the sensor project - Preparing Raspberry Pi - Clayster libraries - Hardware- Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data -
6	External representation of sensor values - Exporting sensor data - Creating the actuator projectHardware - Interfacing the hardware - Creating a controller - Representing sensor values - Parsing sensor data - Calculating control states
7	- Creating a camera - Hardware -Accessing the serial port on Raspberry Pi - Interfacing the hardware - Creating persistent default settings - Adding configurable properties - Persisting the settings - Working with the current settings - Initializing the camera

Elective Group: (09) Internet Of Things

Course Number	Course Name	L-T-P- Credits	Year of Introduction
505-09-D	Smart city use case, MQTT, Integrating on Cloud	2L+1T+0P=3C	2018
<p>Course Objective: The purpose of this course is to impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things, IoT applications and examples overview (building automation, transportation, healthcare, industry, etc.) with a focus on wearable electronics.</p>			
<p>Expected Outcome : At the end of the course a student should be able to upload IoT application on cloud.</p>			
<p>REFERENCES:</p> <ol style="list-style-type: none"> 1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024', Yole Développement Copyrights 2. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan Peter Friess, 'Internet of Things -From Research and Innovation to Market Deployment', River Publishers, 2014 5. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014. <p>http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.htm</p>			
<p>Text Books: Vijay Madiseti and Arshdeep Bahga, “Internet of Things (A Hands-on Approach)”, 1 st Edition, VPT, 2014.</p>			
<p>Suggested MOOC : Please refer these websites for MOOC’s: NPTEL / Swayam, www.edx.com, www.coursera.com</p>			
Course Plan			
Unit	Contents		
1	LoRA, LoRAWAN - Smart City Use Cases Working with Smart City Solutions Problem understanding Introduction to LoRA		
2	LoRA Hardware and bandwidth Communication between Lora Devices,		
3	LoRA Gateway, LoRAWAN WIFI vs BLE vs ZigBee vs LoRA		
4	IoT and Cloud IoT and Cloud introduction		
5	Data ingestion using MQTT		
6	Understanding Device Management Device Security		
7	Device Connectivity MQTT MQTT Introduction Brokers Publish/Service Topics QOS [0, 1, 2 levels] MQTT Message Format Messaging, Ack format Payload Security [TLS, User Authentication] MQTT Authorization		

Elective Group:(10) Big Data

Course Number	Course Name	L-T-P- Credits	Year of Introduction
404-10-A	Business Intelligence Applications	2L-1T-0P= 3C	2018
Course Objective : To introduce learner with Business Intelligence Concept, decision making by Business Intelligence Tools on Applications such as Finance, Marketing, Education etc.			
Pre-requisites: Preliminary knowledge of computer, Big Data Analysis and Business Intelligence.			
Expected Outcome : <ul style="list-style-type: none"> • Good knowledge of Business Intelligence Tools. • Knowledge of Decision making using analysis on the Big Data using Excel Tools. • Case Studies: Knowledge about different applications used in industries. 			
Reference Books : 1. Big Data- Understanding How Big Data Power Big Business –By Bill Schmarzo 2. Business Intelligence Strategy-John Boyer, Bill Frank, Brain Green, Tracy Harris			
Course Plan			
Unit	Contents		
1	Introduction To Business Intelligence Applications: Introduction to Big Data, Business Intelligence Data Mining, and Data Warehousing, What are Business Intelligence Applications (BIA). Features of BIA.		
2	Sales, Finance And Marketing: Introduction to Sales, Finance and Marketing Concept, features of Sales, features of Finance, features of Marketing, Use of Business Intelligence in Sales, Finance and Marketing in any Organization, Case Study.		
3	Education And Learning: Introduction to Education System, Learning Concept, Difficulties in Education Systems, Use of Business Intelligence for Education and Learning, Case Study.		
4	Vertical Ai Applications: Overview of AI, What is Vertical AI, Features of Vertical AI, Use of Business Intelligence in Vertical AI, Case Study.		
5	Security: Define Security, Security in Big Data, Problems with Security, Business Intelligence for Security, Case Study.		
6	Lifescience: Introduction to Life Science, Life Science Intelligence, Features of Life Science Intelligence, Use of Life Science Intelligence in Decision Making, Case Study.		
7	Ad Optimisation: Define Optimization, Introduction to Ad Optimization, Uses of Ad Optimization for Industry, Use if Business Intelligence in Ad Optimization, Case Study.		

Elective Group: (10) Big Data

Course Number	Course Name	L-T-P- Credits	Year of Introduction
405-10-B	Business Intelligence Tools	2L-1T-0P= 3C	2018-2019
<p>Course Objective : To introduce learner with Big Data Concept. Using different Advance Excel Functions (like Optimization) and implementing it on Big Data for decision making. By solving Case Studies the students will get real example of using BI Tools in industry. To introduce learner with Business Intelligence Concept, decision making by Business Intelligence Tools on Applications such as Finance, Marketing, Education etc.</p>			
<p>Pre-requisites: Preliminary knowledge of computer, Big Data Analysis and Business Intelligence.</p>			
<p>Expected Outcome : * Good knowledge of Business Intelligence Tools. * Knowledge of Decision making using analysis on the Big Data using Excel Tools. * Case Studies: Knowledge about different applications used in industries.</p>			
<p>Reference Books :</p> <ul style="list-style-type: none"> ▪ Tutorials Point for advance Excel Tools. ▪ Excel 2010 Bible by John Walkenbach, John Wiley & Sons, 2010 Edition. ▪ https://office.live.com/start/Excel.aspx ▪ https://www.talend.com/ 			
Course Plan			
Unit	Contents		
1	<p>Introduction To Big Data: Overview of - Data Mining, Data Warehousing, Big Data, How Business Intelligence is useful for Big Data, Big Data Problems.</p>		
2	<p>Introduction To Business Intelligence: Introduction to BI, Data Cleaning- Editing a Workbook, Data Cleaning Using Text Function Using Validation To Keep Data Clean, Working with Multidimensional Data- Pivot Table Pivot Charts.</p>		
3	<p>Applications Of Business Intelligence: CRM Domain, Banking Domain, Health Care Domain, Mobile Industry Domain, Creation of a New Product, Providing Personalized Services</p>		
4	<p>Optimization Modeling With Solver: Introduction to MS-Excel and MS-Excel Formulas, Understanding Optimization Modeling, Setting Up a Solver Worksheet, Solving an Optimization Modeling Problem, Reviewing the Solver Reports</p>		
5	<p>Working With Solver: Working With the Solver Options, Setting a Limit on Solver, Understanding the Solver Error Messages, Case Studies (Solver Problems).</p>		
6	<p>Advance Excel Tools: Using Shared Work Books- Sharing a workbook, Opening and editing a shared workbook, Tracking changes, Resolving conflict in a shared workbook, Multiple workbooks- Linking workbooks, Editing the Link, Consolidating the workbook.</p>		
7	<p>Working With Macros: Introduction to Macros? Where are Macros, Features of Macros, Working with Macros- Display the developer Tab, Changing Macro security Settings, Recording and running a Macro.</p>		

Elective Group: (10) Big Data

Course Number	Course Name	L-T-P- Credits	Year of Introduction
504-10-C	Introduction to Big Data	2L-1T-0P= 3C	2018
Course Objective : To introduce learner with Big Data Concept, decision making by doing analysis on the data and managing the data using Big Data Tools like Apache Hadoop, Pig and Hive. What are the problems of Big Data and how it can be solved by different tools.			
Pre-requisites: Preliminary knowledge of computer, Data Mining, Data Warehousing Concepts.			
Expected Outcome : <ul style="list-style-type: none"> • Good knowledge of Big Data Concepts • Knowledge of Decision making using analysis on the Big Data • Introduction to Big data Tools like Hadoop and Weka. 			
Reference Books : 1. Big Data- Understanding How Big Data Power Big Business –By Bill Schmarzo 2. Edureka lectures Link:- https://www.youtube.com/watch?v=A02SRdyoshM			
Course Plan			
Unit	Contents		
1	Introduction: Big Data History, The Big Data Business Opportunity- Business Transformation Imperative, Big Data Business Model, Business Impact of Big Data		
2	Big Data In Organization: Data Analytics Lifecycle, Data Scientist Roles and Responsibilities – Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize, New Organizational Roles, Liberating Organizational Creativity.		
3	Decision Theory And Strategy: Business Intelligence Challenge, Big Data User Interface Ramifications, Human Challenge of Decision Making, Strategy for Decision Making- Big Data Strategy Document, Case Study.		
4	Value Creation Process: Understanding Big Data Value Creation, Value Creation Drivers, Michael Porter’s Value Creation Models- Michael Porter’s Five Forces Analysis, Michael Porter’s Value Chain Analysis, Case Study.		
5	Big Data User Experience: The Unintelligent User Experience, Understanding the Key Decisions to Build a Relevant User Experience, Using Big Data Analytics to Improve Customer Engagement, Uncovering and Leveraging Customer Insights, Big Data can Power a New Customer Experience.		
6	Big Data Use Cases: The Big Data Envisioning Process –1. Research Business Initiatives, 2. Acquire and Analyze your Data, 3. Brainstorm New Ideas , 4. Prioritize Big Data Use Cases, 5. Document Next Steps, The Prioritization Process.		
7	Big Data Architecture: New Big Data Architecture, Introducing Big Data Technologies – Apache Hadoop, MapReduce, R, WEKA etc.		

Elective Group: (10) Big Data

Course Number	Course Name	L-T-P- Credits	Year of Introduction
505-10-D	HADOOP	2L-1T-0P= 3C	2018
Course Objective :			
To introduce learner with HADOOP Tool for Business Intelligence, decision making by doing analysis on the data using HADOOP Tool and also managing the Big Data using HADOOP.			
Pre-requisites: Preliminary knowledge of computer, Big Data Analysis and Business Intelligence. Also students must know Core Java, C Programming and Data Structure Languages.			
Expected Outcome :			
<ul style="list-style-type: none"> • Good knowledge of HADOOP Tool. • Knowledge of Decision making using HADOOP analysis on the Big Data • Hands-on Big Data tools- Hadoop, Pig, Hive, HBase 			
Reference Books :			
1. Big Data- Understanding How Big Data Power Big Business –By Bill Schmarzo			
2. www.tutorialspoint.com			
Course Plan			
Unit	Contents		
1	BIG DATA Overview : What is Big Data?, What Comes Under Big Data?, Benefits of Big Data, Big Data Technologies Operational vs. Analytical Systems, Big Data Challenges.		
2	Introduction To HADOOP: Hadoop Architecture, MapReduce, Hadoop Distributed File System, How Does Hadoop Work?, Advantages of Hadoop.		
3	HDFS Overview: Features of HDFS, HDFS Architecture, Starting HDFS, Listing Files in HDFS, Inserting Data into HDFS, Retrieving Data from HDFS, Shutting Down the HDFS.		
4	MAPREDUCE: What is MapReduce?, The Algorithm for MapReduce, Inputs and Outputs (Java Perspective), Analyze different use-cases where MapReduce is used, Differentiate between traditional way and MapReduce way.		
5	Introduction To Hadoop Features: New Big Data Architecture, Introducing HADOOP Features – Apache Hive, Apache HBase, Pig.		
6	Multi Node Cluster: Multi Node Cluster, Install Java, Creating User Account, Mapping the Nodes, Installing Hadoop, Configuring Hadoop, Start Hadoop Services, Adding New Data Node in the Hadoop Cluster, Removing New Data Node from the Hadoop Cluster.		
7	Environment Setup: Pre-installation Setup, Installing Java Downloading Hadoop Hadoop Operation Modes Installing Hadoop in Standalone Mode Installing Hadoop in Pseudo Distributed Mode Verifying Hadoop Installation, Implement basic Hadoop commands on terminal.		

Elective Group: (11) Cyber Security

Course Number	Course Name	L-T-P- Credits	Year of Introduction
404-11-A	Introduction to Linux	2L+1T+0P=4C	2018
Course Objective: Introduce the learner to Linux environment			
Expected Outcome : Practical understanding of Linux environment			
References (Books, Websites etc) : Red Hat Linux Bible: Fedora and Enterprise Edition - by Christopher Negus			
Suggested MOOC : SWAYAM			
Syllabus			
Unit	Contents		
1	Installation of Kali-Linux, Understanding Kali Linux		
2	Using Shell Interface Introduction to Linux, Internal and external commands, General purpose utilities, Navigating the file system, Handling ordinary files		
3	Using GUI Environments GNOME desktop environment, KDE desktop environment		
4	Using open source office suite: Word processor application , Spreadsheet application, Presentation application, Desktop database application		
5	Using the Internet World wide web, FTP, Telnet		
6	Using Multimedia Graphics, Audio, Video		
7	Shell commands General purpose utilities, File management , Process management, Communication management		

Elective Group: (11) Cyber Security

Course Number	Course Name	L-T-P- Credits	Year of Introduction
405-11-B	Information Security Concepts	2L+1T+0P=3C	2018
Course Objective: Introduce the learner to concepts involved in Information Security domain			
Expected Outcome : Theoretical understanding of Information Security Concepts			
References (Books, Websites etc) : CEH Study Guide - Sybex			
Suggested MOOC : SWAYAM			
Syllabus			
Unit	Contents		
1	Information Security Concepts: Confidentiality, Integrity and Availability of Information, Identification, Authentication and Authorization, Security Principles and Models		
2	Physical Security: Facility Requirement, Perimeter Security, Fire Protection, Fire Suppression, Power Protection, General Environmental Protection, Equipment Failure Protection		
3	Network Security: Secure Network design, Firewalls, WLAN Security, VPNs, Types and Sources of Network Threats		
4	Operating System Security: Windows, Linux/UNIX		
5	Database Security: MS SQL		
6	Web Application Security: Web Application Vulnerabilities, Secure Coding Techniques, Continuous Security Testing and Assessments		
7	Compliance Standards : IT Act, ISO 27001, ITIL Framework		

Elective Group: (11) Cyber Security

Course Number	Course Name	L-T-P- Credits	Year of Introduction
504-11-C	Information Security Threats	2L+1T+0P=4C	2018
Course Objective: Introduce the learner to threats involving Information Systems			
Expected Outcome : Practical understanding of threats involving Information Systems			
References (Books, Websites etc) : CEH Study Guide - Sybex			
Suggested MOOC : SWAYAM			
Syllabus			
Unit	Contents		
1	Introduction to Information Security Threats TCP/IP Fundamentals , Operating System Fundamentals , Web Application and Database Fundamentals , Introduction to Ethical Hacking, Advanced Persistent Threats		
2	Information Gathering: Footprinting, Advanced Google Hacking, Nmapping the network, Fingerprinting		
3	Exploitation: Hacking Networks, Hacking Servers, Hacking Databases, Password Cracking		
4	Advanced Exploitation: Hacking WLANs, Evading IDS, Firewalls, Web Application Hacking, Advanced Web Hacking, Hacking Web Browsers		
5	Social Engineering: Introduction to Social Engineering, Common Types of Attacks, Online Social Engineering		
6	Cryptography: Introduction to Cryptography, Encryption and Decryption, Cryptographic Algorithms, Digital Signature, Cryptography Tools, Cryptography Attacks		
7	Malware Attacks: Viruses, Worms, Trojans		

Elective Group: (11) Cyber Security

Course Number	Course Name	L-T-P- Credits	Year of Introduction
505-11-D	Information Security Administration	2L+1T+0P=3C	2018
Course Objective: Introduce the learner to concepts involving security administration			
Expected Outcome : Practical understanding of setting, managing and securing Information Systems			
References (Books, Websites etc) : Red Hat Linux Bible: Fedora and Enterprise Edition - by Christopher Negus			
Suggested MOOC : SWAYAM			
Syllabus			
Unit	Contents		
1	Setup a Client: Introduction to client-side devices, Setup, Manage and Secure a Desktop PC Setup, Manage and Secure a Mobile Device		
2	Setup a LAN: Introduction to LAN devices, Simulate a LAN, Setup, Manage and Secure a Local Area Network		
3	Connect a LAN to the Internet: Introduction to WAN devices, Setup, Manage and Secure a Connection to the Internet		
4	Share an Internet Connection across a LAN: Introduction to Internet Connection sharing, Introduction to NAT and PAT Setup, Manage and Secure a Proxy Server		
5	Share resources over a LAN: Setup, Manage and Secure a Print Server, Setup, Manage and Secure a File server		
6	Host a Website: Introduction to website hosting, Setup, Manage and Secure a Web Server		
7	Setup support servers: Setup, Manage and Secure a Mail Server, Setup, Manage and Secure a FTP Server, Setup, Manage and Secure a Boot Server, Setup, Manage and Secure a DNS Server		