G.Pullaiah College of Engineering and Technology (Autonomous)

Department of Computer Science and Engineering–Artificial Intelligence and Machine Learning

VSEMESTER(IIIYEAR)									
Course Code	Title of the Course	Category	Periods Per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P	C	Internal	External	Total
A33503	Computer Networks	PC	3	0	0	3	40	60	100
A33555	Big Data Analytics	PC	3	0	0	3	40	60	100
A30512	Design and Analysis of Algorithms	PC	3	0	0	3	40	60	100
	Open Elective-I	OE	2	0	0	3	40	60	100
	Professional Elective-I	PE	3	0	0	3	40	60	100
A33556	Big Data Analytics Laboratory	PC	0	0	3	1.5	40	60	100
A30516	Design and Analysis of Algorithms Lab	PC	0	0	3	1.5	40	60	100
A33557	Advanced Web Technologies	SC	1	0	2	2	40	60	100
A30034	Gender Sensitization	MC	2	0	0	0	100*	0	100*
A33558	SummerInternship2Months(Mandatory)		0	0	0	1.5	100	0	100
	TOTAL		17	01	10	21.5	420	480	900

ProfessionalElective–1	
Course Code	Title o f the Course
A30551	Data mining
A30552	Image processing
A30559	Cyber security and Privacy
A33150	Ethical Hacking
A30579	The Joy of Computing using Python
A30591	Cyber Security

VI SEMESTER(IIIYEAR)									
Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P	C	Internal	External	Total
A33118	Natural Language Processing	PC	2	1	0	3	40	60	100
A30526	Cloud computing	PC	3	0	0	3	40	60	100
A30531	Data Visualization	PC	3	0	0	3	40	60	100
	Professional Elective-II	PE	3	0	0	3	40	60	100
	Open Elective-II	OE	3	0	0	3	40	60	100
A30529	Cloud Computing Laboratory	PC	0	0	3	1.5	40	60	100
A33121	Natural Language Processing Lab	PC	0	0	3	1.5	40	60	100
A30533	Data Visualization Lab (Using Power BI/Tableau etc.,)/	PC	0	0	3	1.5	40	60	100
A30021	Professional English and communication skills laboratory	SA	1	0	2	2	40	60	100
A30036	Indian Constitution and multiculturalism	MC	2	0	0	0	100*	0	100*
	TOTAL		17	01	08	21.5	360	540	900

ProfessionalElective–2	
Course Code	Title of the Course
A33128	Computer Vision
A30527	DevOps
A33137	Recommender Systems
A30558	Design Patterns

G.Pullaiah College of Engineering and Technology(Autonomous)

Department of Computer Science and Engineering–Artificial Intelligence and Machine Learning

VSEMESTER(IIIYEAR)									
Course Code	Title of the Course	Category	Periods Per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P	C	Internal	External	Total
A33503	Computer Networks	PC	3	0	0	3	40	60	100
A33555	Big Data Analytics	PC	3	0	0	3	40	60	100
A30512	Design and Analysis of Algorithms	PC	3	0	0	3	40	60	100
	Open Elective-I	OE	2	0	0	3	40	60	100
	Professional Elective-I	PE	3	0	0	3	40	60	100
A33556	Big Data Analytics Laboratory	PC	0	0	3	1.5	40	60	100
A30516	Design and Analysis of Algorithms Lab	PC	0	0	3	1.5	40	60	100
A33557	Advanced Web Technologies	SC	1	0	2	2	40	60	100
A30034	Gender Sensitization	MC	2	0	0	0	100*	0	100*
A33558	SummerInternship2Months(Mandatory)		0	0	0	1.5	100	0	100
		TOTAL	17	01	10	21.5	420	480	900

ProfessionalElective–1	
Course Code	Title o f the Course
A30551	Data mining
A30552	Image processing
A30559	Cyber security and Privacy
A33150	Ethical Hacking
A30579	The Joy of Computing using Python
A30591	Cyber Security

VI SEMESTER(IIIYEAR)									
Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P	C	Internal	External	Total
A33118	Natural Language Processing	PC	2	1	0	3	40	60	100
A30526	Cloud computing	PC	3	0	0	3	40	60	100
A30531	Data Visualization	PC	3	0	0	3	40	60	100
	Professional Elective-II	PE	3	0	0	3	40	60	100
	Open Elective-II	OE	3	0	0	3	40	60	100
A30529	Cloud Computing Laboratory	PC	0	0	3	1.5	40	60	100
A33121	Natural Language Processing Lab	PC	0	0	3	1.5	40	60	100
A30533	Data Visualization Lab (Using Power BI/Tableau etc.,)/	PC	0	0	3	1.5	40	60	100
A30021	Professional English and communication skills laboratory	SA	1	0	2	2	40	60	100
A30036	Indian Constitution and multiculturalism	MC	2	0	0	0	100*	0	100*
	TOTAL		17	01	08	21.5	360	540	900

ProfessionalElective–2	
Course Code	Title of the Course
A33128	Computer Vision
A30527	DevOps
A33137	Recommender Systems
A30558	Design Patterns

COURSE STRUCTURE

A33503– COMPUTER NETWORKS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	40	60	100

1. Course Description

Course Overview

This course is introduced as a professional core offering insight into important aspects of computer networks. It covers the functionality of each layer in computer networks, besides highlighting the flow of control and congestion control algorithms. This course helps the learner in selecting a domain path leading to cyber security specialization.

2. Course Outcomes (COs)

After completion of the course, the learner will be able to:

A33503.1 Apply the networking concepts in configuring the systems

A33503.2 Illustrates error handling mechanism in data link layer

A33503.3 Analyze the routing algorithms in finding the shortest path

A33503.4 Apply transport protocols in network communications

A33503.5 Implements domain name service and network security in the communication segment.

3. Course Syllabus

UNIT-I

Introduction: Network hardware, Network software, Reference models-OSI,TCP/IP, examples of networks-the internet, 4G mobile phone networks, RFID and sensor networks.

Physical Layer: Guided Transmission, Wireless Transmission, Public switched telephone networks Structure of the telephone system, FDM, TDM, Switching.

UNIT-II

Data Link Layer: Design issues, error detection and correction, elementary data link protocol, sliding window protocols. Medium access sub layer: the channel allocation problem, multiple access protocols, Ethernet, wireless LANS.

UNIT-III

Network Layer: Network layer design issues, routing algorithms-shortest path routing, flooding, hierarchical routing, broadcast, multicast, distance vector routing, link state routing.

Congestion Control: Congestion control algorithms, Quality of service, application requirements, Traffic Shaping, the network layer in the internet, IPV4 protocol, IP- addresses, Internet control protocols, IPV6.

UNIT-IV

Transport Layer: Transport services, elements of transport protocols and the internet transport Protocols TCP and UDP protocols.

UNIT-V

Domain Name System: The DNS name space, domain resource records, name servers, Network security: introduction to cryptography, DES—the Data Encryption Standard, RSA.

4. Books and Materials

Text Book(s)

1. Andrew S. Tanenbaum, David J, *Computer Networks*, Pearson Education /PHI, 5th edition 2016.

Reference Book(s)

1. BehrouzA.Forouzan,*DataCommunicationsandNetworking,*TMH,4thedition2017.
2. S.Keshav*, An Engineering Approach to Computer Networks,* Pearson Education, 2nd edition 2014.

COURSE STRUCTURE

A30530-BIGDATAANALYTICS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	14	0	4	40	60	100

Course Objectives:

- To optimize business decisions and create competitive advantage with BigData analytics
- To learn to analyze the bigdata using intelligent techniques
- To introduce programming tools PIG&HIVE in Hadoop echo system

Course Outcomes:

At the end of the course, the students will be able to

- Illustratebigdatachallengesindifferentdomainsincludingsocialmedia,transportation,finance and medicine
- Use various techniques for mining data stream
- Design and develop Hadoop
- Identifythecharacteristicsofdatasetsandcomparethetrivialdataandbigdataforvariousapplications
- Explore the various search methods and visualization techniques

UNITI:

Introduction: Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis's Reporting.

UNITII:

HDFS: Introduction to Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop File systems, The Java Interface, Data flow.

UNITIII:

How MapReduce Works: Developing a Map ReduceApplication, How Map Reduce Works, The Configuration API, setting up the Development Environment, Running Locally on Test Data, running on a Cluster, Anatomy of a MapReduce, Job Run, Failures, Shuffle and Sort, Task Execution.

Map Reduce Types and Formats: Map Reduce Types, Input formats, output formats.

UNITIV:

Hadoop Environment: Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration, Security.

Pig: Installing and Running Pig, an Example, Comparison with Databases, Pig Latin, User- Defined Functions, Data Processing Operators.

UNITV:

Hive: Installing Hive, Running Hive, Comparison with traditional Databases, HiveQL, Tables, Querying Data.

Spark: Installing Spark, Resilient Distributed Datasets, Shared Variables, Anatomy of a Spark Job Run.

HBase: HBasics, Installation, clients, Building an Online Query Application.

TextBooks:

1. TomWhite,"Hadoop:TheDefinitiveGuide",ThirdEdition,O'reillyMedia,FourthEdition,2015.
2. ChrisEaton,DirkDeRoos,TomDeutsch,GeorgeLapis,PaulZikopoulos,"UnderstandingBigData: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill Publishing, 2012.
3. AnandRajaramanandJeffreyDavidUllman,"MiningofMassiveDatasets",CUP,2012

ReferenceBooks:

1. BillFranks,"TamingtheBigDataTidalWave:FindingOpportunitiesinHugeDataStreamswith AdvancedAnalytics",JohnWiley&sons,2012.
2. Paul Zikopoulos, DirkdeRoos, KrishnanParasuraman, Thomas Deutsch, James Giles, David Corrigan,"Harness the Power ofBig Data: TheIBM BigData Platform", Tata McGraw HillPublications,2012.
3. ArshdeepBahgaandVijayMadisetti,"BigDataScience&Analytics:AHandsOnApproach",VPT,2016.
4. BartBaesens,"AnalyticsinaBigDataWorld:TheEssentialGuidetoDataScienceanditsApplications (WILEYBigDataSeries)",JohnWiley&Sons,2014.

SoftwareLinks

1. Hadoop:http://hadoop.apache.org/
2. Hive:https://cwiki.apache.org/confluence/display/Hive/Home
3. Piglatin:http://pig.apache.org/docs/r0.7.0/tutorial.html

COURSESTRUCTURE

A30512–DESIGNANDANALYSISOFALGORITHMS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	40	60	100

1. Course Description

Course Overview

This course enables the learner to identify complexity of a given algorithm and techniques. It covers various algorithm design techniques, basic computability concepts and the complexity classes P, NP, NP-Complete are introduced for solving hard problems. The learners of the course can tackle the complex algorithmic problems with great ease in real world situations.

Course Pre/co requisites

1. A30503-DataStructures

2. Course Outcomes (COs)

After completion of the course ,the learner will be able to:

A30512.1 Analyze the efficiency of algorithm for a given problem.

A30512.2 Formulate the time order analysis for given algorithm.

A30512.3 Identify the mathematical techniques required to prove the time complexity of an algorithm.

A30512.4 Design appropriate algorithm to solve real world problems.

A30512.5 Develop an application with the designed algorithms.

3. Course Syllabus

UNIT-I

Introduction: Algorithm, specifications of algorithm, algorithm measurement divide and conquer: general method, binary search, finding the maximum and minimum, merge sort, quick sort, selection sort, stressen's matrix multiplication

UNIT-II

Greedy Method & Dynamic Programming: General method, knapsack problem, job scheduling with deadlines, minimum cost spanning trees, optimal storage on tapes, single-source shortest paths. Dynamic programming: General method, multistage graphs, all-pairs shortest paths, 0/1 knapsack, the travelling salesperson problem.

UNIT-III

Basic Traversal and Search Techniques & Back tracking: Basic traversal and search techniques: traversal techniques for binary trees, traversal techniques for graphs, connected components and spanning trees, bi-connected components Back tracking: Common method, 8 – queens problem, sum of subsets problem, graph coloring and Hamiltonian cycles.

UNIT-IV

Branch and Bound & Lower Bound Theory: Branch and bound :the method, travelling salesperson, 0/1knapsack problem lower bound theory: comparison trees, lower bounds through reductions – multiplying triangular matrices ,inverting a lower triangular matrix, computing the transitive closure.

UNIT-V

NP–Hard and NP–Complete Problems: NP hardness , NP completeness, consequences of being P,cook's theorem, halting problem, non-deterministic problem, clique's, SAT problem.

4. Books and Materials

TextBook(s)

1. EllisHorowitz,S.SatrajSahaniandRajasekhran,*FundamentalsofComputerAlgorithms*,2nd Edition, UniversityPress.2014.

Reference Book(s)

1. ParagHimanshuDave,HimanshuBhalchandraDave,PearsonEducation,*DesignandAnalysisofAlgorithms*,PearsonEducation,2nd Edition,2009
2. T.H.Cormen,C.E.Leiserson,R.L.RivestandC.Stein, *Introduction to Algorithms*, 2nd Edition,PHIPvt.Ltd./Pearson Education.

G.PULLAIAHCOLLEGEOFENGINEERINGANDTECHNOLOGY,KURNOOL

COURSESTRUCTURE

A30532-BIGDATAANALYTICSLABORATORY

HoursPerWeek			HoursPerSemester			Credits	AssessmentMarks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	42	1.5	40	60	100

Software Requirements:

1. **Hadoop:**https://hadoop.apache.org/release/2.7.6.html
2. **Java :**https://www.oracle.com/java/technologies/javase/javase8u211-later-archive-downloads.html
3. **Eclipse:**https://www.eclipse.org/downloads/

List of Experiments:

Experiment1:

Week1,2:

1. INSTALL VMWARE
2. Installation of VMWare along with linux to setup the Hadoop environment and its ecosystems.

Experiment2:

Week3:

1. (i)Perform setting up and Installing Hadoop in its three operating modes:
   Standalone, Pseudo distributed, Fully distributed

(ii)Use web based tools to monitor your Hadoop setup.

Experiment3:

Week4:

2. Implement the following file management tasks in Hadoop:
   - Adding files and directories
   - Retrieving files
   - Deleting files

Hint:A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

Experiment4:

Week5:

3. Run a basic Word Count MapReduce program to understand MapReduce Paradigm**.**

Experiment5:

Week6:

4. A Matrix Multiplication Program in MapReduce Style That will Run on Hadoop Platform Using Map Reduce

Experiment6:

Week7:

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5. Write a mapreduce program that mines weather data.
   Weathersensorscollectingdataeveryhouratmanylocationsacrosstheglobegatheralargevolume oflogdata,whichisagoodcandidateforanalysiswithMapReduce,sinceitissemistructuredand record-oriented.

Experiment7: Week8:

6. Installation of Apache PIG.

Experiment 8:

Week 9:

7. Write Pig Latin scripts sort, group, join, project, and filter your data.

Experiment9:

Week10:

8. a. Run the Pig Latin Scripts to find Word Count

b.Run the Pig Latin Scripts to find a max temp for each and every year.

Experiment10:

Week11:

9. Install and Run Hive then use Hive to create, alter, and drop data bases, tables ,views, functions, and indexes

Experiment11:

Week12:

10. Installation of HBase, import data of a file in HBase table.

G.PULLAIAHCOLLEGEOFENGINEERINGANDTECHNOLOGY,KURNOOL

COURSESTRUCTURE

A33121-DESIGN AND ANALYSIS OF ALGORITHMSLABORATORY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	42	1.5	40	60	100

1. Course Description

Course Overview

This Laboratory drives the learners to experience the complexity of a given algorithm and give programmatic solutions. It gives hands on practice in implementing various algorithmic design techniques, in solving problems. This helps the learners to solve the complex problems in any domain demanding algorithmic solutions.

Course Pre/corequisites

1. A30504-Data Structures Laboratory
2. A30510-Object oriented programming through java laboratory

2. Course Outcomes(COs)

After completion of the course, the learner will be able to:

A30516.1 Apply basic programming techniques in solving given problem.
A30516.2 Design an algorithm for a given application program.
A30516.3 Utilize wrapper classes as per the demand of problem.
A30516.4 Apply the appropriate algorithmic technique for efficient problem solving.
A30516.5 Execute collection classes for dynamic programming.

Course Syllabus

List of Experiments

1. Create a Java class called Student with the following details as variables within it. (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create n Student objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.
2. Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.
3. Write a Java class called Customer to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as and display as using StringTokenizer class considering the delimiter character as"/".
4. Sort a given set of elements using the best sorting method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java which technique is good to calculate time complexity analysis: worst case, average case and best case.
5. Write a java program to implement the following sorting techniques by using Divide and Conquer Method: a) Insertion Sort b) Selection sort
6. Write a java program for an array of jobs where every job has a deadline and associated profit if the job is finished before the deadline. It is also given that every job takes single unit of time, so the minimum possible deadline for any job is 1. How to maximize total profit if only one job can be scheduled at a time.
7. Write java code to check whether a given graph is strongly connected or not. Given an integer array nums, find the contiguous subarray (containing at least one number) which has the largest sum and return its sum.(Using Dynamic Programming) Example: Input: [- 2,1,-3,4,-1,2,1,-5,4], Output: 6 Explanation: [4,-1,2,1] has the largest sum = 6.
8. Write a java for the given an undirected weighted connected graph consisting of n vertices and m edges. The task is to find any spanning tree of this graph such that the maximum degree over all vertices is maximum possible. The order in which you print the output edges does not matter and an edge can be printed in reverse also i.e. (u, v) can also be printed as (v, u).
9. Write a Java Program is to Implement Knight‟s Tour Problem.A knight‟s tour is a sequence of moves of a knight on a chessboard such that the knight visits every square exactly once. If the knight ends on a square that is one knight‟s move from the beginning square (so that it could tour the board again immediately, following the same path), the tour is closed, and otherwise it is open. The exact number of open tours on an 8×8 chessboard is still unknown.

10.a. Design and implement in Java to find a subset of a given set S = {Sl, S2, ,Sn} of n positive integers whose SUM is equal to a given positive integer d.

b. Write a program to print all permutations of a given string using Backtracking.

4. Laboratory Equipment/Software/Tools Required

1. Open source Java Tool kit: JDK 8 and above versions
2. A diagramming tool: A diagramming tool lets you draw pictures of your network. Visio (from Microsoft).
3. A network discovery program: For larger networks, you may want to invest in a network discovery program such as Spice works.
4. A protocol analyzer: A protocol analyzer monitors and logs the individual packets that travel along your network. (Protocol analyzers are also called packet sniffers.) , Network Monitor tool.

1. Books and Materials

Text Book(s)

1. Ellis Horowitz, S. SatrajSahani and Rajasekhran, Fundamentals of Computer Algorithms,2nd Edition, University Press.2014. Reference Book(s) 1. ParagHimanshu Dave, HimanshuBhalchandra Dave, Design and Analysis of Algorithms, Pearson Education, 2nd Edition, 2009.
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, Introduction to Algorithms, PHI Pvt. Ltd./ Pearson Education
3. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill

COURSESTRUCTURE

A33557-WEB TECHNOLOGIES

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	40	60	100

1. Course Description

Course Overview

This course makes the students to enrich their knowledge in web technologies by applying HTML,CSS concepts in developing the web pages. It highlights the importance of client and server side scripting languages like PHP and XML. It also focuses on the web services and their importance.Thelearnersofthiscoursecanchoosetheircareeraswebdeveloper.

Course Pre/corequisites

A30506-ObjectOrientedprogrammingthroughJava

2. Course Outcomes(COs)

After completion of the course, the learner will be able to:

A30513.1 Construct a basic website using HTML and Cascading Style Sheets.

A30513.3 Build dynamic web page using Java Script objects and event handling mechanisms.

A30513.3 Develop server side programs using Servlets and Java Server Page.

A30513.4 Construct web pages in PHP to represent data in XML format.

A30513.5 Use AJAX and web services to develop interactive web applications

3. Course Syllabus

UNIT-I

Website Basics, Html 5, CSS 3, Web 2.0 9 Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTPResponseMessage–WebClients–WebServers–HTML5–Tables–Lists–Image–HTML5controlelements–Semanticelements–DragandDrop–Audio–Videocontrols-CSS3–Inline,embeddedand external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images –Colors –Shadows–Text–Transformations –Transitions–Animations.

UNIT-II

Client Side Programming Java Script: An introduction to JavaScript–JavaScript DOM Model-Dateand Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event HandlingDHTMLwithJavaScript-JSONintroduction–Syntax–FunctionFiles–HttpRequest–SQL.

UNIT-III

Server Side Programming Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions Session Handling- Understanding Cookies-Installing and Configuring Apache Tomcat Web Server-DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example.

UNIT-IV

PHP and XML An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-infunctionsFormValidation-RegularExpressions-Filehandling–Cookies-Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation.

UNIT-V

Introduction to Ajax and Web Services: AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction –Java web services Basics–Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application–SOAP.

4. Books and Materials

Text Book(s)

1. Deitel and Deitel and Nieto, *Internet and World Wide Web - How to Program*‖,Prentice Hall,5th edition,2015.
2. A.A.Puntambekar,*InternetProgramming,*Technicalpublications,2nd Edition,2019

Reference Book(s)

1. Chris Bates, *Web Programming – Building Intranet Applications*, 3rd Edition, WileyPublications,2009.
2. GopalanN.P.andAkilandeswariJ.,—*WebTechnology*‖,Prentice HallofIndia,2011.

G.PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL

COURSESTRUCTURE

A30034-GENDER SENSITIZATION

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	28	0	0	0	100	0	100

1. Course Description

Course Overview

The main objective of this course is to develop student's sensibility with regard to issues of gender in contemporary India and to provide a critical perspective on the socialization of men and women. It also introduces students to information about some key biological aspects of genders to expose the students to debates on the politics and economics of work. This course helps the students to reflect critically on gender violence.

2. Course Outcomes(COs)

After completion of the course, the learner will be able to:

A30034.1 Develop a better understanding of important issues related to gender in contemporary India.

A30034.2 Sensitize to basic dimensions of the biological, sociological ,psychological and legal aspects of gender.

A30034.3Acquire insight into the gendered division of labor and its relation to politics and economics.

A30034.4 Equip to work and live together as equals

A30034.5 Develop a sense of appreciation of women in all walks of life

3. Course Syllabus

UNIT-I

UNDERSTANDING GENDER: Gender: Why should we study it Socialization: Making Women, Making MenIntroduction, preparing for Woman hood, growing up Male, First lessons in Caste, Different Masculinities**UNIT-II**

GENDERANDBIOLOGY:MissingWomen:SexSelectionanditsconsequencesDecliningSexRatio,Demographic Consequences Gender Spectrum: Beyond the Binary Two or Many? Struggles withDiscrimination,Additional Reading:OurBodies,OurHealth.

UNIT-III

GENDER AND LABOUR: Housework: The Invisible Labour "My Mother Doesn't Work". "Share the Load",Women'sWork:ItsPoliticsandEconomicsFactandFiction,UnrecognizedandUnaccountedwork

UNIT-IV

ISSUES OF VIOLENCE: Sexual Harassment: Say No! Sexual Harassment, not Eve-Teasing-Coping withEveryday Harassment Domestic Violence: Speaking Out Is Home a Safe Place? - When Women Unite[Film], Rebuilding Lives Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life….."**UNIT-V**

GENDERSTUDIES:Knowledge:ThroughtheLensofGenderPointofView,GenderandtheStructureofKnowledge. Who's History? Questions for Historians and Others Reclaiming a Past, Writing otherHistories.

4. Books and Materials

Text Book(s)

1. A.Suneeta,UmaBhrugubanda,Towardsaworldofequals:ABilingualTextbookongender

ReferenceBook(s)

1. Sen,Amartya.“MorethanoneMillionWomenareMissing.”NewYorkReviewofBooks 37, 20(20DecembeR2090). print

Professional Elective-I

COURSESTRUCTURE

A30551–DATA MINING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	40	60	100

1. Course Description

Course Overview

This course is introduced to drive the students to reach the depth of data science with warehousing and mining concepts. It covers data pre-processing, mining frequent patterns, associations and correlations, classification and prediction, and cluster analysis**.** In addition to this it paves way for machine learning algorithms. This helps the student to choose the career path in data science and architect the data for better decision making.

Course Pre/corequisites

A35006-DatabaseManagementSystems

2. Course Outcomes(COs)

After completion of the course, the learner will be able to:

A30551.1 Apply the principles of business intelligence in the commercial

segmentA30552.2Makeuseofpre-processingtechniquesfordataorganization

A30553.3Implementassociation,clustering and rule based mining for Market based analysis

A30554.4Analyzethedatamining classification technique for data differentiation

A30555.5Designtheunsupervisedclusteringalgorithmsfordataanalysis

3. Course Syllabus

UNIT-I

Data Mining: Fundamentals of data mining, data mining functionalities, classification of data mining systems, data mining task primitives.

UNIT-II

Data Pre Processing: Descriptive data summarization, data cleaning, data integration and transformation, data reduction, data discretization and concept hierarchy generation.

UNIT-III

Mining Frequent Patterns, Associations and Correlations: Efficient and scalable frequent item set mining methods , association rules, and correlation analysis

UNIT-IV

Classification and Prediction: Decision tree induction, various classification methods, accuracy and error measures, ensemble methods.

UNIT-V

Cluster Analysis: Types of data in cluster analysis, categorization and partitioning, hierarchical, density-based, grid-based, model-based clustering methods, outlier analysis.

4. Books and Materials

Text Book(s)

1. JiaweiHan,MichelKamber,*DataMiningConceptsandTechniques*,3/e,Elsevier,2019.

Reference Book(s)

1. AlexBerson,StephenSmith,*DataWarehousingDataMining &OLAP*,TMH.

2. K.P.Soman,S.Diwakar,V.Ajay,*InsightintoDataMining*,PHI,2008.

G.PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL

COURSE STRUCTURE

A30552-IMAGE PROCESSING

HoursPerWeek			HoursPerSemester			Credits	AssessmentMarks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	40	60	100

1. Course Description

Course Overview

Inthiscoursestudentswilllearndigitalimageprocessingtechniquesincludingrepresentation,sampling and quantization, image acquisition, imaging geometry, image transforms, image enhancement, image smoothing and sharpening, and image restoration.

2. Course Outcomes(COs)

After completion of the course, the learner will be able to:

A30552.1 Interpret fundamental concepts of digital and colour image processing.

A30552.2 Exemplify image enhancement.

A30552.3 Analyze the various terminologies involved in image segmentation like edge, boundary detection etc. Assess image compression techniques for digital images.

A30552.4 Summarize segmentation techniques for digital images.

UNIT-I:

INTRODUCTIONTODIGITALIMAGEPROCESSING

Introduction: Digital image representation, Fundamental steps in image processing, Elements of digital image processing, Elements of visual perception, Simple image model, Sampling and Quantization, Basic relationships between pixels, Image transformations. Applications: Medical imaging, Robot vision, Character recognition, Remote sensing.

UNIT–II:

IMAGE ENHANCEMENT: Need for image enhancement, Point processing, Histogram processing, Spatial filtering-Smoothing and Sharpening.

UNIT-III:

COLORIMAGEPROCESSING: Colour fundamentals, Colour models, Color transformations, Pseudo colour image processing, Full colour image processing.

UNIT–IV:

IMAGE COMPRESSION : Redundancies ,Fidelity criteria, Image compression model, Loss less compression: Huffman coding, Arithmetic coding. Lossy compression: Lossy Predictive Coding, JPEG Compression Standard.

UNIT–V:

IMAGESEGMENTATION: Detection of discontinuities :point, line and edge detection, Edge linking and Boundary.

Detections: Local Processing, Global processing via Hough transform,T hresholding ,Region oriented

segmentation: Region growing, Region splitting and merging.

4.Books and Materials

Text Book(s)

1.RafaelC.GonzalezandRichardE.Woods,“DigitalImageProcessing”,3rdEdition,PearsonEducation, 2011.

ReferenceBook(s)

1. SJayaraman,SEsakkirajanandTVeerakumar,“DigitalImageProcessing”,TMH,2011.

2. S.Sridhar,“DigitalImageProcessing”,2ndEdition,OxfordPublishers,2016.

COURSE STRUCTURE

A30591 – Cyber Security and Privacy

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. COURSE OBJECTIVES:

The objective of the course is to present an introduction to Ethical techniques with an emphasis on how to organize, maintain and secure the data - efficiently, and effectively.

2. COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

A33150.1 Describe the fundamental topics of hacking and network connectivity.

A33150.2 Implement the tools and techniques of Ethical hacking.

A33150.3 Learn the privacy, design and secure operations using cryptographic algorithms.

A33150.4 Apply the security and integrity tools in the cryptography system

A33150.5 Improving the secure and network systems.

3. COURSE SYLLABUS

UNIT I

Introduction to cyber security: Confidentiality, Integrity and Availability. Foundations, Fundamental concepts, CIA, CIA triangle, data breach at target, Security management.

UNIT II

Governance, risk, compliance: (GRC)- GRC framework, security, Contingency planning, Incidence response, Disaster Recovery, BCP, Cyber security policy, ESSP, Risk Management.

UNIT III

Cyber Risk Identification: Assessment and Control, Cyber security in Industry perspective, defence Technologies Attack, Exploits, Information privacy, Theories.

UNIT IV

Cyber security technologies: Access control, Encryption, Standards. Foundations of privacy, Measurement, Privacy regulation-privacy, Anonymity, Regulation.

UNIT V

Data Breach: Privacy regulation in Europe,Privacy, The Indian Way - Data Protection, GDPR, DPDP, Aadhar, Economics and strategy, Economic value of privacy, privacy valuation, WTA and WTC, Business strategy and privacy,Espionage, Privacy vs safety.

4. Books and Materials

Text Book:

Michael E. Whitman, Herbert J. Mattord, (2018). Principles of Information Security, 6th edition, Cenage Learning, N. Delhi.

References:

1.Darktrace, “Technology” https://www.darktrace.com/en/technology/#machine-learning, accessed November 2018.

2.Van Kessel, P. Is cyber security about more than protection? EY Global Information Security Survey 2018-

2019.
3.Johnston, A.C. and Warkentin, M. Fear appeals and information security behaviors: An empirical study. MIS Quarterly, 2010.
4.Arce I. et al. Avoiding the top 10 software security design flaws. IEEE Computer Society Center for Secure Design (CSD), 2014.

COURSE STRUCTURE

A33150-Ethical Hacking

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. COURSE OBJECTIVES:

The objective of the course is to present an introduction to Ethical techniques with an emphasis on how to organize, maintain and secure the data - efficiently, and effectively.

2. COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

1. Describe the fundamental topics of hacking and network connectivity.
2. Implement the tools and techniques of Ethical hacking.
3. Learn the privacy, design and secure operations using cryptographic algorithms.
4. Apply the security and integrity tools in the cryptography system
5. Improving the secure and network systems.

3. COURSE SYLLABUS

UNIT I: INTRODUCTION TO ETHICAL HACKING

Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol stack, IP addressing and routing, TCP and UDP, IP subnets, and Routing protocols,types IP version 6.

UNIT II: ATTACKER AND VICTIM SYSTEM

Installation of attacker and victim system, Information gathering using advanced google search,archive.org, netcraft, whois, host, dig, dnsenum and NMAP tool**.** Vulnerability scanning using NMAP,Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment.

UNIT III:SYSTEM HACKING

Introduction, System Hacking password cracking, privilege escalation, application execution. Malware and Virus. ARP spoofing and MAC attack. Introduction to cryptography, private-key encryption, public-key encryption. Cryptographic hash functions, digital signature and certificate, applications. Steganography, biometric authentication, network-based attacks.

UNIT IV: DNS AND EMAIL SECURITY.

Introduction, Packet sniffing using Wireshark and burp suite, password attack using burp suite.Social engineering attacks and Denial of service attacks. Elements of hardware security: side-channel attacks, physical inclinable functions, hardwaretrojans.

UNIT V : SECURE BOOT MECHANISMS

Introduction,Different types of attacks using Metasploit framework: password cracking, privilege escalation, remote code execution, etc.Attack on web servers: password attack, SQL injection,Case studies: various attacks scenarios and their remedies.

4. Books and Materials

Textbooks:

1. Data and Computer Communications -- W. Stallings.
2. Introduction to Computer Networks and Cybersecurity -- C-H. Wu and J. D. Irwin
3. Cryptography and Network Security: Principles and Practice -- W. Stallings

Reference Books:

2. Data Communication and Networking -- B. A. Forouzan
3. TCP/IP Protocol Suite -- B. A. Forouzan
4. UNIX Network Programming -- W. R. Stallings

Online Learning Resources:

1) Ethical Hacking Professional Certificate | NPTEL-12 weeks course

COURSE STRUCTURE

A30579 –The Joy of Computing Using Python

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

"The Joy of Computing Using Python" is an engaging introduction to programming with Python, designed for beginners. The course covers fundamental concepts such as variables, control structures, functions, and data structures in a hands-on manner. Students will learn to write and debug code while exploring practical applications in problem-solving and data manipulation. Emphasis is placed on building computational thinking and fostering creativity through interactive projects. By the end, participants will have a solid foundation in Python and the confidence to tackle more advanced programming challenges. The course combines theoretical knowledge with practical exercises to ensure a well-rounded learning experience

Course Pre/corequisites

Basic Mathematics, Computer Operation

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A30579.1: Demonstrate proficiency in Python basics, including variables, loops, and conditionals for simple applications.
A30579.2: Apply abstraction and problem-solving techniques to develop applications and games using Python.
A30579.3: Implement and analyze algorithms such as recursion and sorting in practical scenarios.
A30579.4: Handle and analyze data using techniques like image processing, sentiment analysis, and natural language processing.
A30579.5: Develop interactive and automated solutions, including browser automation and calendar manipulation, using Python.

3. Course Syllabus

UNIT-I

Motivation for Computing, Welcome to Programming!!Introduction to Anaconda, Spyder IDE, Variables and Expressions: Design your own calculator, Loops and Conditionals: Hopscotch once again, Lists Crowd computing, Permutations: Jumbled Words

UNIT-II

Abstraction Everywhere: Apps in your phone, Magic Square hit, Dobble game, Counting Candies: Crowd to the rescue Birthday, Guess the movie, Dictionaries, Sorting and Searching,

UNIT-III

Substitution Cipher: What's the secret!! Sentiment, Tic tac toe: Let's play, Recursions, Snakes and Ladders: Down the memory lane.Spiral Traversing, Track the route,

UNIT-IV

Tuples, Lottery Simulation, Image Processing, Anagrams, Sentiment Analysis: Analyse your Facebook data, Natural Language Processing, six degrees of separation: Meet your favourites Image, Calculation of the Area: Don't measure.

UNIT-V

Flames, Data Compression, Browser Automation, Fun with Calendar, Page Rank: How Google Works!!

4. Books and Materials

Textbook(s)

1. **Charles R. Severance.***Python for Everybody: Exploring Data Using Python 3.* A beginner-friendly book that explains core Python concepts like variables, loops, conditionals, and functions. It also delves into topics such as web scraping, databases, and data visualization.
2. **Allen B. Downey.***Think Python: How to Think Like a Computer Scientist.* An introductory textbook that emphasizes problem-solving and computational thinking, aligning well with beginner-level courses in Python.

Reference Book(s)

1. **Al Sweigart.***Automate the Boring Stuff with Python.* A highly practical reference for automating everyday tasks like file management, web scraping, and working with Excel files using Python.
2. **John Zelle.***Python Programming: An Introduction to Computer Science.* A more computer science-oriented introduction to Python that dives into computational theory and algorithms along with Python coding.
3. **Luciano Ramalho.***Fluent Python: Clear, Concise, and Effective Programming.* A good reference for more advanced users, focusing on writing more Pythonic and efficient code.
4. **Mark Lutz.***Learning Python.* A comprehensive book that covers the Python language in-depth. It's a good resource for beginners and intermediate programmers who want to dive deeper into the language.

COURSE STRUCTURE

A30591 – Cyber Security and Privacy

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. COURSE OBJECTIVES:

The objective of the course is to present an introduction to Ethical techniques with an emphasis on how to organize, maintain and secure the data - efficiently, and effectively.

2. COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

A33150.1 Describe the fundamental topics of hacking and network connectivity.

A33150.2 Implement the tools and techniques of Ethical hacking.

A33150.3 Learn the privacy, design and secure operations using cryptographic algorithms.

A33150.4 Apply the security and integrity tools in the cryptography system

A33150.5 Improving the secure and network systems.

3. COURSE SYLLABUS

UNIT I

Introduction to cyber security: Confidentiality, Integrity and Availability. Foundations, Fundamental concepts, CIA, CIA triangle, data breach at target, Security management.

UNIT II

Governance, risk, compliance: (GRC)- GRC framework, security, Contingency planning, Incidence response, Disaster Recovery, BCP, Cyber security policy, ESSP, Risk Management.

UNIT III

Cyber Risk Identification: Assessment and Control, Cyber security in Industry perspective, defence Technologies Attack, Exploits, Information privacy, Theories.

UNIT IV

Cyber security technologies: Access control, Encryption, Standards. Foundations of privacy, Measurement, Privacy regulation-privacy, Anonymity, Regulation.

UNIT V

Data Breach: Privacy regulation in Europe,Privacy, The Indian Way - Data Protection, GDPR, DPDP, Aadhar, Economics and strategy, Economic value of privacy, privacy valuation, WTA and WTC, Business strategy and privacy,Espionage, Privacy vs safety.

4. Books and Materials

ext Book:

Michael E. Whitman, Herbert J. Mattord, (2018). Principles of Information Security, 6th edition, Cenage Learning, N. Delhi.

References:

1.Darktrace, “Technology” https://www.darktrace.com/en/technology/#machine-learning, accessed November 2018.

2.Van Kessel, P. Is cyber security about more than protection? EY Global Information Security Survey 2018-2019.

3.Johnston, A.C. and Warkentin, M. Fear appeals and information security behaviors: An empirical study. MIS

Quarterly, 2010.
4.Arce I. et al. Avoiding the top 10 software security design flaws. IEEE Computer Society Center for Secure Design (CSD), 2014.

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P	C	Internal	External	Total
A33118	Natural Language Processing	PC	2	1	0	3	40	60	100
A30526	Cloud computing	PC	3	0	0	3	40	60	100
A30531	Data Visualization	PC	3	0	0	3	40	60	100
	Professional Elective-II	PE	3	0	0	3	40	60	100
	Open Elective-II	OE	3	0	0	3	40	60	100
A30529	Cloud Computing Laboratory	PC	0	0	3	1.5	40	60	100
A33121	Natural Language Processing Lab	PC	0	0	3	1.5	40	60	100
A30533	Data Visualization Lab (Using Power BI/Tableau etc.,)/	PC	0	0	3	1.5	40	60	100
A30021	Professional English and communication skills laboratory	SA	1	0	2	2	40	60	100
A30036	Indian Constitution and multiculturalism	MC	2	0	0	0	100*	0	100*
		TOTAL	**17**	**01**	**08**	**21.5**	**360**	**540**	**900**

Professional Electives

Professional Elective–2	
Course Code	**Title of the Course**
A33128	Computer Vision
A30527	DevOps
A33137	Recommender Systems
A30558	Design Patterns

COURSESTRUCTURE

A33118 – Natural Language Processing

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	14	0	4	40	60	100

1. Course Description

Course Overview

Natural language processing (NLP) presents a solution to this problem, offering a powerful tool for managing unstructured data. IBM defines NLP as a field of study that seeks to build machines that can understand and respond to human language, mimicking the natural processes of human communication.ReadonasweexploretheroleofNLPintherealmofartificialintelligence.

Course Pre/corequisites

A30528-Machinelearningtechniques

2. Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1: Understand the logic behind Natural languages

CO2: Understand the significance of syntax and semantics of natural languages

CO3: Process the Natural languages

CO4: Verify the syntax and semantics of languages

CO5: Design new natural languages

3. Course Syllabus

UNIT-I

Introduction to Natural language

The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural languageUnderstandingSystems,LinguisticBackground:AnoutlineofEnglishSyntax.

UNIT-II

Grammars and Parsing

Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

UNIT-III

Grammars for Natural Language:

Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

UNIT-IV

Interpretation and Modeling

Semantic Interpretation-Semantic & Logical form, Word senses & ambiguity, the basic logical form language, encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts & embedded sentences, Defining semantics structure model theory.

UNIT-V

Machine Translation and Multilingual Information

Machine Translation Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets

Books and Materials

Text Book(s):

1. JamesAllen,NaturalLanguageUnderstanding,2ndEdition,2003, PearsonEducation.
2. Multilingual Natural Language Processing Applications: From Theory to Practice-Daniel M.Bikel andImedZitouni,PearsonPublications.
3. Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet Chaitanya, Prentice –Hall ofIndia.

Reference Books:

1. Charniack,Eugene,StatisticalLanguageLearning,MITPress,1993.

2. Jurafsky,DanandMartin,James,SpeechandLanguageProcessing,2ndEdition,PrenticeHall,2008.

3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MITPress,1999.OnlineLearningResources:http://peterindia.net/AILinks.htm

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COURSESTRUCTURE

A30526-CLOUD COMPUTING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	14	0	4	40	60	100

1. Course Description

Course Overview

The aim of the course is to provide insight of cloud computing architecture and its services. It includes various cloud service models including Infrastructure as a Service (IaaS), Platform as a Service(PaaS) and Software as a Service (SaaS). This course helps the learner to best utilize the cloud services in their domain and helps in choosing cloud computing as their profession.

Course Pre/corequisites

A35014- Operating systems
A35015-ComputerNetworks

2. Course Outcomes (COs)

After completion of the course, the learner will be able to:

A30526.1 Analyze cloud delivery models for better architecture.

A30526.2 Implement infrastructure as a service model for industrial applications.

A30526.3 Organize the cloud platform model for optimization services.

A30526.4 Develop various application software with software as service.

A30526.5 Design cloud computing reference architecture for delivery models.

3. Course Syllabus

UNIT-I

Introduction Of Delivery Models In Cloud Computing: introduction to cloud delivery models, list various cloud delivery models, advantages of delivery models in cloud, trade-off in cost to install versus flexibility, cloud service model architecture.

UNIT-II

Infrastructure as a Service(IaaS): Introduction to Infrastructure as a Service delivery model, characteristics of IaaS, architecture, examples of IaaS, applicability of IaaS in th eindustry.

UNIT-III

Platform as a Service (PaaS): Introduction to Platform as a Service delivery model, characteristics of PaaS, patterns, architecture and examples of PaaS, applicability of PaaS in the industry.

UNIT-IV

Software as a Service (SaaS): Introduction to Software as a Service delivery model, characteristics of SaaS, architecture, examples of SaaS, applicability of SaaS in the industry.

UNIT-V

Cloud Computing Reference Architecture (CCRA): Introduction to cloud computing reference architecture (CCRA), benefits of CCRA, architecture overview, versions and application of CCRA for developing clouds.

4. Books and Materials

Text Book(s):

1. RajkumarBuyya,JamesBroberg,andAndrzejGoscinski,*CloudComputing:PrinciplesandParadigms* byWileyPress,NewYork,USA,2017.

Reference Book(s):

1. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper,*Cloud computing for Dummies*(November2016).

2. MichaelJ.Kavis,*ArchitectingtheCloud:DesignDecisionsforCloudComputingServiceModels*by,WileyPress, 2016.

3. MichaelJ.Kavis,GautamShroff,*EnterpriseCloudComputingTechnologyArchitectureApplications*,CambridgeUniversityPress,2013.

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COURSESTRUCTURE

A30531-DATAVISUALIZATION

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	14	0	4	40	60	100

Course Objectives:

The aim of the course is to provide insight of learn different statistical methods for Data visualization. Learn basics of R and Python. To learn usage of Watson studio. To learn about packages Numpy, pandas and mat plotlib. To learn functionalities and usages of Sea born.

Course Outcomes:

After Completion of this course, students would be able to-

- Apply statistical methods for Data visualization.
- Gain knowledge on Rand Python
- Understand usage of various packages in R and Python.
- Demonstrate knowledge of Watson studio.
- Apply data visualization tools on various datasets**.**

UNITI

Introduction to Statistics: Introduction to Statistics, Difference between inferential statistics and descriptive statistics, Inferential Statistics- Drawing Inferences from Data, Random Variables, Normal Probability Distribution, Sampling, Sample Statistics and Sampling Distributions. R overview and Installation- Overview and About R, R and R studio Installation, Descriptive Data analysis using R, Description of basic functions used to describe data in R.

UNITII

Data manipulation with R : Data manipulation packages, Data visualization with R. Data visualization in Watson Studio: Adding data to data refinery, Visualization of Data on Watson Studio.

UNITIII

Python: Introduction to Python, How to Install, Introduction to Jupyter Notebook, Python scripting basics, Numpy and Pandas.

UNITIV

Data Visualization Tools in Python- Introduction to Matplotlib, Basic plots using matplotlib, Specialized Visualization Tools using Matplotlib, Advanced Visualization Tools using Matplotlib- Waffle Charts, Word Clouds.

UNITV

Introduction to Sea born: Sea born functionalities and usage, Spatial Visualizations and Analysis in Python with Folium, Case Study.

TEXTBOOKS:

1. CorePythonProgramming-SecondEdition,R.NageswaraRao,DreamtechPress.
2. RGraphicsEssentialsforGreatDataVisualizationbyAlboukadelKassambara

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COURSESTRUCTURE

A30529–CLOUDCOMPUTINGLABORATORY

HoursPerWeek			HoursPerSemester			Credits	AssessmentMarks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	42	1.5	40	60	100

1. CourseDescription

CourseOverview

The aim of the laboratory is to provide insight of cloud computing architecture and its services. Studentsgainhands-onpracticeonvariouscloudservicemodelsincludingInfrastructureasaService(IaaS),PlatformasaService(PaaS),andSoftwareasaService(SaaS)usingAmazonWebServices(AWS),Microsoft azure and Google cloud platform. This course helps the learner to best utilize the cloud servicesintheirdomainandevenhelpsinchoosingcloudcomputingastheirprofession.

CoursePre/corequisitesA30014-Operating systemsA30015-Computer NetworksA35021-CloudComputing

2. CourseOutcomes(COs)

Aftercompletionof thecourse, thelearnerwillbeableto:

A30529.1 Develop and deploy applications for better cloud utilityA30529.2Design webservicesformoderncommercialapplications

A30529.3 Analyze the performance, scalability, and availability of the underlying cloud technologies forbusinessrequirements

A30529.4Implementsoftwareinstallationforutilityofitsapplications

A30529.5Comparevariouscloudcomputingplatformsforbettercloudservices

3. CourseSyllabus

Listofcloudcomputingprograms

1:Creating aWarehouseApplicationinSalesForce.com.
2:CreatinganApplicationinSalesForce.comusingApexProgrammingLanguage.3:ImplementationofSOAPWebservicesinC#/JAVAApplications.
4:Para-VirtualizationusingVMWare‘sWorkstation/Oracle‘sVirtualBoxandGuestO.S.5:Installation andConfigurationofHadoop
6:Createanapplication(Ex: WordCount)usingHadoopMap/Reduce.7:CaseStudy:PAAS(Facebook,GoogleAppEngine).
8:CaseStudy:AmazonWebServices

4. LaboratoryEquipment/Software/ToolsRequired

1. AmazonWebServices (AWS)
2. MicrosoftAzure
3. GoogleCloudPlatform

5. BooksandMaterials

TextBook(s)

1. RajkumarBuyya,JamesBroberg,andAndrzejGoscinski,*CloudComputing:PrinciplesandParadigms* byWileyPress,NewYork,USA,2017.

ReferenceBook(s)

1. JudithHurwitz,RobinBloor,MarciaKaufman,FernHalper,*CloudcomputingforDummies*(November 2016).

2. Michael J. Kavis, *Architecting the Cloud: Design Decisions for Cloud Computing Service Models* by,WileyPress,2016.

COURSESTRUCTURE

A33121-NATURALLANGUAGEPROCESSINGLABORATORY

HoursPerWeek			HoursPerSemester			Credits	AssessmentMarks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	42	1.5	40	60	100

2. CourseDescription

CourseOverview

- The aim of the laboratory is to provide NLP techniques for text representation, semantic extractiontechniques, data structuresandmodeling. Deep understanding of text representationtechniques (suchas n-grams, bag of words, sentiment analysis etc), statistics and classification algorithms.An analyticalmind with problem-solving abilities.Degree in Computer Science, Mathematics, Computational Linguisticsorsimilarfield.

CoursePre/corequisites

A30528-Machinelearningtechniques

3. CourseOutcomes(COs)

Aftercompletion ofthecourse,thelearnerwillbeableto:

CO1:Understandapproachestosyntaxandsemanticsin NLP.CO2

:Analysegrammarformalismandcontextfreegrammars

CO3:Applythestatisticalestimationandstatisticalalignmentmodels

CO4:ApplyRulebasedTechniques, StatisticalMachinetranslation(SMT), wordalignment

CO5:Havetheskills(experience)ofsolvingspecificNLPtasks,whichmayinvolveprogramminginPython,as well as runningexperiments ontextualdata.

4. CourseSyllabus

Listofcloudcomputingprograms

1:WordAnalysis.

2:WordGeneration.

3:Morphology.

4:N-Grams.

5:N-Grams Smoothing

6:POSTagging:HiddenMarkovModel.7:

POSTagging:ViterbiDecoding.

8:BuildingPOSTagger9

:Chunking

10:BuildingChunker

5. LaboratoryEquipment/Software/ToolsRequired

NaturallanguageTool Kit(NLTK)

6. BooksandMaterials

TextBook(s)

1. T1.JamesAllen,NaturalLanguageUnderstanding,2ndEdition,2003,PearsonEducation.
2. T2.NaturalLanguageProcessing,Apaninianperspective,AksharBharathi,VineetChaitanya,Prentice–Hallof India.

ReferenceBook(s)

1. JamesAllen,NaturalLanguageUnderstanding,2ndEdition,2003, PearsonEducation.

2.Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet Chaitanya, Prentice –Hall ofIndia.OnlineLearningResources/VirtualLabs:1.NaturalLanguageProcessinginTensorFlow|Coursera

COURSESTRUCTURE

A30533-DATAVISUALISATIONLABORATORY

HoursPerWeek			HoursPerSemester			Credits	AssessmentMarks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	42	1.5	40	60	100

COURSEOBJECTIVES:

Studentswillbeableto

1. Understandtheimportanceof datavisualizationforbusinessintelligenceanddecisionmaking.
2. Knowapproachestounderstandvisualperception
3. Learnaboutcategoriesofvisualizationandapplicationareas
4. Familiarizewiththedatavisualizationtools
5. Gainknowledgeofeffectivedatavisualstosolveworkplaceproblems

COURSEOUTCOMES:

Attheendof thecourse,Studentswillbeableto:

1. UsePython,RandTableaufordatavisualization
2. Applydatavisualstoconveytrendsindataovertimeusingtableau
3. Constructeffectivedatavisualstosolveworkplaceproblems
4. Exploreandworkwithdifferentplottinglibraries
5. Learnandcreateeffectivevisualizations

LISTOFEXPERIMENTS

1. IntroductiontovariousDataVisualizationtools
2. BasicVisualizationinPython
3. BasicVisualizationinR
4. IntroductiontoTableauand Installation
5. ConnectingtoDataandpreparingdatafor visualizationinTableau
6. DataAggregationandStatisticalfunctionsinTableau
7. DataVisualizationsinTableau
8. BasicDashboardsinTableau

ReferenceBooks:

1. 1.Datavisualizationwithpython:createanimpactwithmeaningfuldatainsightsusinginteractiveandengagingvisuals,MarioDobler,TimGrobmann,PacktPublications,2019
2. PracticalTableau:100Tips,Tutorials,andStrategiesfromaTableauZenMaster,RyanSleeper,OreillyPublications,2018
3. DataVisualizationwithR:111 ExamplesbyThomasRahlf,Springer,2020

COURSESTRUCTURE

A30036INDIANCONSTITUTIONANDMULTICULTURALISM

HoursPerWeek			HoursPerSemester			Credits	AssessmentMarks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	28	0	0	0	100	0	100

1. Course DescriptionCourseOverview

This course is designed in such a way that it gives an overview of Indian Constitution. This course providesthe knowledge on importance of constitution, structure of executive,legislature and judiciary, centralandstaterelationfinancial andadministration.

CoursePre/corequisites

Therearenoprerequisitesandcorequisitesforthiscourse.

2. CourseOutcomes(COs)

Aftercompletionof thecourse, thelearnerwillbeableto:

A30036.1Understand historical background of the constitution making and its importance for building ademocraticIndia.

A30036.2 ExplaintheroleofPresidentandPrimeMinister.

A30036.3 Understandthefunctioningofthreewingsofthegovernmentie.,executive,legislativeandjudiciary.

A30036.4 UnderstandthevalueofthefundamentalrightsanddutiesforbecominggoodcitizenofIndia

A30036.5 Analyze the decentralization of power between central, state and local self-government.A30036.6Applytheknowledgeinstrengthening oftheconstitutional institutionslikeCAG,Election CommissionandUPSCforsustaining democracy.

3. Course SyllabusUNIT-I

Introduction to IndianConstitution: Indian Constitution - Sources and constitutionalhistory, Features-Citizenship,Preamble,FundamentalRightsandDuties, DirectivePrinciples ofStatePolicy.

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-Staterelationship, President: Role, power and position, Prime Minister and Council of ministers, Cabinet andCentralSecretariat,LokSabha,RajyaSabha, TheSupremeCourtandHighCourt:PowersandFunctions.

UNIT-III

StateGovernmentanditsAdministration:Governor-RoleandPosition–ChiefMinisterandCouncilofministers,StateSecretariat:Organization,StructureandFunctions.

UNIT-IV

Local Administration: District's Administration Head - Role and Importance, Municipalities - Mayor androleofElectedRepresentative-CEOofMunicipalCorporationPachayatiRaj:FunctionsPRI:ZillaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy -(Different departments), Village level - Role of Elected and Appointed officials - Importance of grass rootdemocracy.

UNIT-V

ElectionCommission: ElectionCommission-

RoleofChiefElectionCommissionerandElectionCommissionerate State Election Commission: Functionsof Commissionsfor the welfare of SC/ST/OBCandwomen.

4. Books and Materials

TextBook(s)

1. DurgaDasBasu,*Introduction totheConstitutionofIndia*,PrenticeHall ofIndiaPvt.Ltd.NewDelhi.
2. SubashKashyap,*IndianConstitution*,NationalBookTrust.

ReferenceBook(s)

1. A. Siwach,*DynamicsofIndianGovernment&Politics*.
2. D.C.Gupta,*IndianGovernmentandPolitics*.
3. H.M.Sreevai, *Constitutional LawofIndia*,4th editionin3volumes(UniversalLawPublication)

Professional Elective-II

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COURSESTRUCTURE

A33128–ComputerVision

Professional Elective Course–II

HoursPerWeek			HoursPerSemester			Credits	AssessmentMarks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	40	60	100

1. CourseObjectives:

- Theobjectiveofthiscourseistounderstandthebasicissuesincomputervisionandmajorappro achesthat address them.
- StudentsshouldbeabletolearntheLinearFilters,Segmentationbyclustering,Edgedetection.

Pre-requisite

2. CourseOutcomes(CO):

Aftercompletionofthecourse,studentswillbe ableto

A33128.1 Identify basic concepts, terminology, theories, models and methods in the field of computervision.

A33128.2 Describe basic methods of computer vision related to multi-scale representation, edgedetectionanddetectionofother primitives, stereo,motionandobject recognition.

A33128.3 Develop the practical skills necessary to build computer vision

applications.A33128.4Exposuretoobjectandscenerecognitionandcategorizationfromi

mages.

3. CourseSyllabus:

UNIT –I **LINEARFILTERS**

Introduction to Computer Vision, Linear Filters and Convolution, Shift In variant Linear Systems,SpatialFrequencyandFourierTransforms,SamplingandAliasing,FiltersasTemplates,Techni que:NormalizedCorrelationandFindingPatterns,Technique:ScaleandImagePyramids.

UNIT–II **EDGEDETECTION**

Noise- Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, EstimatingDerivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter,WhySmoothwith aGaussian? DetectingEdges-UsingtheLaplaciantoDetectEdges.

UNIT–III **TEXTURE**

RepresentingTexture–ExtractingImageStructurewithFilterBanks,RepresentingTextureUsing the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids - TheLaplacianPyramid, FiltersintheSpatialFrequencyDomain, OrientedPyramids.,

UNIT–IV **SEGMENTATIONBYCLUSTERING**

WhatisSegmentation,HumanVision:GroupingandGestalt,Applications:ShotBoundaryDetectionan dBackgroundSubtraction, ImageSegmentationby Clustering

Pixels,SegmentationbyGraph-TheoreticClustering.

NIT –V **RECOGNIZATION BY RELATIONS BETWEENTEMPLATES**

Finding Objects by Voting on Relations between Templates, Relational Reasoning Using ProbabilisticModels and Search, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM andSignLanguageUnderstanding, FindingPeoplewithHMM.

4. Textbooks:

1.DavidA. Forsyth,JeanPonce,ComputerVision- AModernApproach,PHI,2003.

ReferenceBooks:

1. GeometricComputingwithCliffordAlgebras:TheoreticalFoundationsandApplicationsinComputer VisionandRobotics,Springer;1edition,2001by Sommer.
2. DigitalImageProcessingandComputerVision,1/e,bySonka.
3. ComputerVisionandApplications:ConciseEdition(WithCD)byJack,AcademyPress,2000.

OnlineLearningResources:

1. Introductionto ComputerVisionandImageProcessing|Coursera
2. AdvancedComputerVisionwithTensorFlow|Coursera

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COURSESTRUCTURE
A30527-DevOps

HoursPerWeek			HoursPerSemester			Credits	AssessmentMarks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. CourseDescription

This course enlightens the agile relationship between development and IT operations and provides theknowledgeaboutvariousDevOpstools.Itfocusesonprofessionalprinciplesthathelpbusiness unitsCollaborateinsidetheenterpriseandbreakdowntraditionalsilos.Thelearnercanleadhis/herprofessionalcareerinserviceandcommercialenterprises.

2. CoursePre/corequisites

A1510SoftwareEngineering

3. CourseOutcomes(COs)

Aftercompletionofthecourse,thelearnerwillbeableto:

A30527.1AnalyzeDevOpsmethodologiesincollaborationwiththeDevelopmentandOperations teamA30527.2 Apply configuration management strategies for better integrations and deploymentA30527.3MakeuseofvariousDevOpstoolstoeaseofcollaborationanddevelopment

A30527.4Determinethespeedofproductivityforintimedelivery

A30527.5Applicationdeploymentandconfigurationforuninterruptedusage

4. CourseSyllabus

UNIT-I

SDLC:IntroductiontoSDLC,agilemodel.

IntroductiontoDevops:Introduction,Devopsfeatures,workmanagement,sourcecodemanagement,buildautomation,deliveryautomation,understandingcodequality,automationofCI/CD.

UNIT-II

SourceCodeManagement: What is version control and GIT, standard branchingworkflows,BranchingWorkflow,GitHubflow.

UNIT - III

Build Automation , CI: Build(CI) Orchestration using Jenkins automation server, build tools ,ApacheMaven, Gradle, Ant, NPM/Node.js, pipeline Basics, Jenkins master, node, agent, and execu tor, freestyleprojects&pipelines.

UNIT-IV

ArtifactManagement:Nexus,JFrogArtifactory,JFrogArtifactoryasKubernetisregistry,HelmchartforMicrosoftazurepipeline.

Continuous Delivery: Software componentscanbe released in short cycles,everychange isautomaticallydeployedtotheDevenvironment.

UNIT-V

ContinuousDeployment: Extendscontinuousdelivery,everychangeisautomaticallydeployedtoProduction,CD

Flow,containerizationwithDocker,IntroductiontoDocker,images&containers,DockerFile,workingwith containers and publish to Docker Hub, Configuration management Ansible, Introduction to Ansible, Ansibletasks,Roles,Jinjatemplates,vaults,deploymentsusingAnsible.

4. Books and Materials

TextBook(s)

1. Gene Kim, Jez Humble, Patrick Debois, John Willis, *The DevOps Handbook: How to Create World,ClassAgility,Reliability,*2016.

ReferenceBook(s)

1. MichaelHuttermann,*DevOpsforDevelopers*,2012.
2. JoakimVerona**,***PracticalDevOps,*packetopensourcepublications*,*2016.

COURSESTRUCTURE

A33137–RECOMMENDERSYSTEMS

HoursPerWeek			HoursPerSemester			Credits	AssessmentMarks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	40	60	100

1. CourseOverview

This specialisation on Recommender Systems covers the most important of recommendationalgorithms,includingcontent-basedandcollaborativefiltering,dimensionalityreduction,hybridtechniques, cross-domainandcontext-awaretechniques.

2. CourseOutcomes

A33137.1Tounderstandbasictechniques andproblemsinthefieldofrecommendersystems

A33137.2 Evaluate Types of recommender systems: non-personalized, content based, collaborativefiltering.

A33137.3 Apply algorithms and techniques to develop Recommender Systems that are widely usedintheInternet industry.

A33137.4Todevelopstate-of-the-artrecommendersystems

3. Course

SyllabusUNIT-I

An Introduction to Recommender Systems, Neighbourhood -Based Collaborative Filtering, Goals ofRecommenderSystems,BasicModelsofRecommenderSystems,Domain-SpecificChallengesinRecommender Systems. Advanced Topics and Applications. Introduction, Key Properties of RatingsMatrices,PredictingRatingswithNeighbourhood-Neighbourhood-BasedCollaborativeFiltering:BasedMethods,ClusteringandNeighbourhood-BasedMethods,DimensionalityReductionandNeighbourhoodMethods,GraphModelsforNeighbourhood-BasedMethods,ARegressionModellingViewof NeighbourhoodMethods

UNIT -II

Model-BasedCollaborativeFiltering,Content-BasedRecommenderSystems,DecisionandRegression Trees, Rule-Based Collaborative Filtering, Naive Bayes Collaborative Filtering, Using anArbitrary Classification Model as a Black-Box, Latent Factor Models, Integrating Factorization andNeighbourhoodModels.

Content-BasedRecommenderSystems:

Introduction, Basic Components of Content-Based Systems, reprocessing and Feature Extraction,Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations, UsingContent-BasedModels forCollaborativeFiltering, Summary.

UNIT–III

Knowledge-BasedRecommenderSystems,Ensemble-BasedandHybridRecommenderSystems,Constraint-BasedRecommenderSystems,Case-BasedRecommenders,PersistentPersonalization in Knowledge-Based Systems, Summary.Ensemble Methods from the ClassificationPerspective, Weighted Hybrids, Switching Hybrids, Cascade Hybrids, Feature Augmentation Hybrids,Meta-LevelHybrids, FeatureCombinationHybrids, Summary.

UNIT-IV

Evaluating Recommender Systems, Context-Sensitive Recommender Systems, Evaluation Paradigms,General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, AccuracyMetricsinOfflineEvaluation,LimitationsofEvaluationMeasures,LimitationsofEvaluationMeasures.The Multidimensional Approach, Contextual Pre-filtering: A Reduction-Based Approach,ContextualPre-filtering: AReduction-BasedApproach, ContextualModelling.

UNIT–V

Time-andLocation-SensitiveRecommenderSystems,TemporalCollaborativeFiltering,DiscreteTemporal Models, Location-Aware Recommender Systems, Location-Aware Recommender SystemsLocation-AwareRecommender Systems, Summary.

4. Books and Materials

Textbooks:

1. CharuC.Aggarwal,“RecommenderSystems”,Springer,2016.

5.ReferenceBooks:

1. FrancescoRicci,LiorRokach,“RecommenderSystemsHandbook”,2nded.,Springer,2015Edition

6.OnlineLearningResources:

1. RecommendationSystem-UnderstandingtheBasicConcepts(analyticsvidhya.com)
2. RecommenderSystems|Coursera

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COURSE STRUCTURE

A30558-DESIGN PATTERNS

HoursPerWeek			HoursPerSemester			Credits	AssessmentMarks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	40	60	100

1. CourseDescription

CourseOverview

Thiscourseextendsobject-orientedprogrammingbyincorporatingdesignpatternstocreateinteractive applications. It includes patterns like creational, structural and behavioral. In addition it helps torecognizeadesignandenablestominimizetheamountofrefactoringbyusingprimitivetechniquessuchas objects, inheritance, and polymorphism. The learners will have a foundation to build more complexsoftwareapplications.

CoursePre/corequisites

A1505-Object-orientedprogramming throughJAVA

2. CourseOutcomes(COs)

Aftercompletionof thecourse, thelearnerwillbeableto:

A30558.1 Apply the model-view-controller architecture for a given applicationA30558.2 Propose the most suitable design pattern to solve a design problemA30558.3Inspectexistingcodetoperformsoftwarerefactoring

A30558.4Applythebasicdesignprinciplesforqualitysoftware

3. Course

SyllabusUNIT-I

IntroductiontoDesignPatterns: Designpatterndefinition,designpatternsinSmallTalkMVC,describing design patterns, catalog of design patterns, organizing the catalog, solving of design problems usingdesignpatterns,selectionofadesignpattern, useofdesignpatterns.

UNIT-II

CreationalPatterns:Abstractfactory,builder,factory method,prototype,singleton,discussionofcreationalpatterns.

UNIT-III

Structural Patterns: Adapter, bridge, composite**. Structural Patterns-2**: Decorator, façade, flyweight,proxy,discussofstructuralpatterns.

UNIT-IV

BehavioralPatternsPart-1: Chainofresponsibility,command,interpreter,iterator,mediator,memento,observer.

UNIT-V

Behavioral Patterns Part -2: State, strategy, template method, visitor, and discussion of behavioralpatterns.Whattoexpectfromdesignpatterns,abriefhistory,thepatterncommunityaninvitation,ap artingthought.

4. BooksandMaterials

TextBook(s):

1. ErichGamma,Rechard helm,Ralpjohnson,Johnvlissides,*DesignPatternsElements of reusableobject-orientedsoftware*,PearsonEducation,2015.

ReferenceBook(s):

1. MarkGrand,*PatternsinJAVA*Vol-I, II&III,WileyDreamTech,2016.
2. EricFreeman,Head*FirstDesignPatterns*,secondedition,O'reilly-spd2014.