KKR & KSR INSTITUTE OF TECHNOLOGY AND SCIENCES

(Autonomous)

DEPARTMENT OF CSE - DATA SCIENCE

COURSE STRUCTURE & SYLLABUS
(Regulations – R20)

For B. Tech DEPARTMENT OF CSE - DATA SCIENCE
(Applicable for Batches admitted from 2020-2021)

KKR & KSR INSTITUTE OF TECHNOLOGY AND SCIENCES

(Autonomous)

(Accredited by NBA & NAAC with Grade "A" and Affiliated to JNTUK-Kakinada)
Vinjanampadu, Vatticherukuru Mandal, Guntur-522017.
Andhra Pradesh. INDIA

DEPARTMENT OF CSE - DATA SCIENCE
COURSE STRUCTURE & SYLLABUS – R20

SEMESTER - I

S No	Course Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	20CS1T01	Problem Solving and Programming Using C	3	0	0	3	30	70	100
2	20SH1T04	Applied Chemistry	3	0	0	3	30	70	100
3	20SH1T06	Differential Equations	3	0	0	3	30	70	100
4	20ME1T01	Engineering Graphics	1	0	4	3	30	70	100
5	20EE1T02	Basics of Electrical and Electronics Engineering	3	0	0	3	30	70	100
PRACTICAL									
6	20CS1L01	Problem Solving and Programming Using C Lab	0	0	3	1.5	15	35	50
7	20CS1L02	IT Workshop	0	0	3	1.5	15	35	50
8	20SH1L04	Applied Chemistry Lab	0	0	3	1.5	15	35	50
		Total Credits				**19.5**	**195**	**455**	**650**

Theory: BSC-2, ESC-3 **Practical:** BSC-1, ESC-2

SEMESTER - II

S. No	Course Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	20SH2T01	Communicative English	3	0	0	3	30	70	100
2	20SH2T02	Applied Physics	3	0	0	3	30	70	100
3	20SH2T07	Linear Algebra & Vector Calculus	3	0	0	3	30	70	100
4	20EC2T01	Digital Logic Design	3	0	0	3	30	70	100
5	20CS2T01	Python Programming	3	0	0	3	30	70	100
6	20GE2M01	Environmental Sciences	2	0	0	0	--	--	--
PRACTICAL									
6	20SH2L01	English Communicative Skills Lab	0	0	3	1.5	15	35	50
7	20SH2L02	Applied Physics Lab	0	0	3	1.5	15	35	50
8	20CS2L01	Python Programming Lab	0	0	3	1.5	15	35	50
		Total Credits				**19.5**	**195**	**455**	**650**

Theory: BSC-2, HSMC-1, ESC-2 **Practical:** BSC-1, HSMC-1, ESC-1 MC: 1

DEPARTMENT OF CSE - DATA SCIENCE
COURSE STRUCTURE & SYLLABUS – R20
SEMESTER-III

S. No	Course Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	20SH3T05	Probability & Statistics	3	0	0	3	30	70	100
2	20CS3T04	Mathematical Foundations of Computer Science	3	0	0	3	30	70	100
3	20CS3T05	Data Structures & Algorithms	3	0	0	3	30	70	100
4	20CD3T01	Fundamentals of Data Science	3	0	0	3	30	70	100
5	20CS3T01	Database Management Systems	3	0	0	3	30	70	100
6	20GE3M01	Constitution of India	2	0	0	0	--	--	--
PRACTICAL									
7	20CS3L03	Data Structures & Algorithms Lab	0	0	3	1.5	15	35	50
8	20CD3L01	Fundamentals of Data Science Lab	0	0	3	1.5	15	35	50
9	20CS3L01	Database Management Systems Lab	0	0	3	1.5	15	35	50
10	20CS3S01	Mobile App Development	1	0	2	2.0	--	50	50
Total Credits						**21.5**	**195**	**505**	**700**

Theory: BSC-01,PCC-3,ESC-01: **Practical:** PCC-3,SC-01,MC-01

SEMESTER - IV

S. No	Course Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	20SH4T03	Numerical Methods & Transformations	3	0	0	3	30	70	100
2	20IT4T01	Object Oriented Programming Through Java	3	0	0	3	30	70	100
3	20CS4T02	Formal Languages and Automata Theory	3	0	0	3	30	70	100
4	20CD4T01	Data warehousing and Mining	3	0	0	3	30	70	100
5	20SH4T01	Managerial Economics and Financial Analysis	3	0	0	3	30	70	100
PRACTICAL									
6	20IT4L01	Object Oriented Programming Through Java Lab	0	0	3	1.5	15	35	50
7	20CD4L01	Data Mining using Python Lab	0	0	3	1.5	15	35	50
8	20CS4L03	R Programming Lab	0	0	3	1.5	15	35	50
9	20CS4S01	Mongo DB	1	0	2	2.0	--	50	50
Total Credits						**21.5**	**195**	**505**	**700**

Theory: BSC-01, PCC-2,ESC-01,HSMC-01: **Practical:** PCC-03,SC-01

COURSE STRUCTURE & SYLLABUS – R20
SEMESTER-V

S.No	Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	20IT5T01	Design and Analysis of Algorithms	3	0	0	3	30	70	100
2	20CI5T02	Machine Learning	3	0	0	3	30	70	100
3	20IT5T02	Operating Systems	3	0	0	3	30	70	100
4	20XX5O1X	**Open Elective-I**	3	0	0	3	30	70	100
5	20CD5E1X	**Professional Elective-I** 1. Software Engineering 2. Object Oriented Analysis and Design 3. Principles of Programming Languages **4.** Internet of Things	3	0	0	3	30	70	100
6	20GE5M03	Professional Ethics & Human values	2	0	0	0	--	--	--
PRACTICAL									
7	20CD5L01	Operating Systems Lab	0	0	3	1.5	15	35	50
8	20CI5L02	Machine Learning Lab	0	0	3	1.5	15	35	50
9	20CD5S01	**Skill Oriented Course – III** 1. Animation course: Animation Design 2. Google Firebase	1	0	2	2.0	15	35	50
10	PR	**Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V Semester.**	0	0	0	1.5	15	35	50
Total Credits						**21.5**	**210**	**490**	**700**

Theory: PCC-4,OE-01,HSMC-01: **Practical:** PCC-02,SC-01,PR-01

COURSE STRUCTURE & SYLLABUS – R20
SEMESTER - VI

S.No	Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	20CD6T01	Computer Networks	3	0	0	3	30	70	100
2	20CD6T02	Big Data Analytics	3	0	0	3	30	70	100
3	20CD6T03	Neural Networks And Deep Learning	3	0	0	3	30	70	100
4	20XX6O2X	**Open Elective- II**	3	0	0	3	30	70	100
5	20CD6E2X	**Professional Elective- II** 1. Compiler Design 2. Software Project Management 3. Distributed Systems 4. Fundamentals of Robotics	3	0	0	3	30	70	100
6	20GE6M03	IPR & Patents	2	0	0	0			
PRACTICAL									
7	20CD6L01	Computer Networks Lab	0	0	3	1.5	15	35	50
8	20CD6L02	Big Data & Hadoop Lab	0	0	3	1.5	15	35	50
9	20CD6P01	Mini Project with Seminar	0	0	3	1.5	15	35	50
10	20CD6S01	**Skilled Oriented Course - IV** 1. Amazon Web Services / DevNet 2. Continuous Integration and Continuous Delivery using DevOps	1	0	2	2.0	15	35	50
Total Credits						**21.5**	**210**	**490**	**700**

Theory: PCC-4,OE-01, HSMC-01: **Practical:** PCC-02,PR-01, SC-01

DEPARTMENT OF CSE - DATA SCIENCE

COURSE STRUCTURE & SYLLABUS – R20
SEMESTER-VII

S. No	Course Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	20CD7E3X	**Professional Elective- III** 1. Natural Language Processing 2. Cryptography and Network Security 3. Image and video processing 4. Block Chain Technologies	3	0	0	3	30	70	100
2	20CD7E4X	**Professional Elective- IV** 1. Artificial Intelligence 2. Cloud Computing 3. Computer Vision 4. Human Computer Interaction	3	0	0	3	30	70	100
3	20CD7E5X	**Professional Elective- V** 1. Social Network Analysis 2. Recommender Systems 3. Data Visualization **4.** Text Mining	3	0	0	3	30	70	100
4	20XX7O3X	**Open Elective-III**	3	0	0	3	30	70	100
5	20XX7O4X	**Open Elective-IV/ Job Oriented**	3	0	0	3	30	70	100
6	20SH7T01	Management Science	3	0	0	3	30	70	100
PRACTICAL									
7	20CD7PR01	**Industrial/Research Internship 2 months (Mandatory) after third year (to be evaluatedduring VII semester**	0	0	0	3	15	35	50
8	20CD7S01	**Skilled Oriented Course-V** 1. Soft Skills	0	0	4	2.0	15	35	50
Total Credits						**23.0**	**210**	**490**	**700**

Theory: PCC-3,OE-02, HSMC-01: **Practical:**,PR-01, SC-01

SEMESTER - VIII

S. No	Course Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	20CD8P01	Major Project Work, Seminar,Internship	0	0	0	12	60	140	200
Total Credits						12			

Open Electives Offered To Other Departments
1. Object Oriented Programming (C++)
2. Data Structures
3. Data warehouse and Mining
4. Big Data Analysis

CONSOLIDATE MARKS/CREDITS:

SEM.	No. Theories	No. Practical's	Mini/ Final Project	MC/ MOOCS	Skill orient/ Advance	Internship	Credits	IM	EM	TM
I	5	3	-	-	-	-	19.5	195	455	650
II	5	3	-	1	-	-	19.5	195	455	650
III	5	3	-	1	1	-	21.5	195	505	700
IV	5	3	-	-	1	-	21.5	195	505	700
V	5	2	-	1	1	1	21.5	210	490	700
VI	5	2	1	1	1	-	21.5	210	490	700
VII	6	0	-	-	1	1	23.0	210	490	700
VIII	-	-	1	-	-	-	12.0	60	140	200
Total	**36**	**16**	**2**	**4**	**5**	**2**	**160**	**1470**	**3530**	**5000**

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - I

Course Code	Course Name	L	T	P	C
20CS1T01	PROBLEM SOLVING AND PROGRAMMING USING C	3	0	0	3

Course Objectives:

The objectives of Programming for Problem Solving Using C are

- To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
- To gain knowledge of the operators, selection, control statements and repetition in C
- To learn about the design concepts of arrays, strings, enumerated structure and union types. To learn about their usage.
- To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor
- To assimilate about File I/O and significance of functions

Course Outcomes:

At the end of the Course, the student will be able to

CO1: Build algorithms and to draw flowcharts for solving problems
CO2: Convert flowcharts/algorithms to C Programs, compile and debug programs
CO3: Use different operators, data types and write programs that use two-way/ multi-way selection
CO4: Select the best loop construct for a given problem
CO5: Design and implement programs to analyze the different pointer applications
CO6: Decompose a problem into functions and to develop modular reusable code

UNIT I

Introduction to Computers: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers Introduction to the C Language: Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Type Qualifiers. Structure of a C Program: Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs.

UNIT II

Bitwise Operators: Exact Size Integer Types, Logical, Bitwise Operators, Shift Operators.
Selection & Making Decisions: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions. Repetition: Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples.

UNIT III

Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages Strings: String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application.

UNIT IV

Pointers: Introduction, Pointers to pointers, Compatibility, L value and R value Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application. Processor Commands: Processor Commands.

UNIT V

Functions: Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Storage Classes, Scope, life time, Passing Array to Functions, Passing Pointers to Functions, Command Line Arguments, Recursion Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

Text Books:

1) Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE.
2) The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson.

Reference Books:

1) Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill.
2) Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson.
3) Computer Fundamentals and Programming in C, PradipDey, Manas Ghosh, OXFORD.

E-Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.programiz.com/c-programming
3. https://www.javatpoint.com/c-programming-language-tutorial
4. https://www.javatpoint.com/c-programming-language-tutorial

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - I

Course Code	Course Name	L	T	P	C
20SH1T04	APPLIED CHEMISTRY	3	0	0	3

COURSE OUTCOMES:

At the end of the Course, the student will be able to

CO1 : Understand the importance of plastics and composites in various fields.
CO2 : Apply corrosion control methods to protect metals.
CO3 : Understand the importance of advanced materials in engineering.
CO4 : Understand computational chemistry and importance of molecular machines.
CO5 : Understand the use of non-conventional energy sources to produce power

UNIT-I: POLYMER TECHNOLOGY

Polymerisation: Introduction-methods of polymerization (emulsion and suspension)-physical and mechanical properties.

Plastics: Compounding-fabrication (compression, injection, blown film, extrusion) - preparation, properties and applications of PVC, polycarbonates and Bakelite-mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

Elastomers: Natural rubber-drawbacks-vulcanization-preparation, properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes).

Composite materials: Fiber reinforced plastics-conducting polymers-biodegradable polymers.

UNIT-II: ANALYTICAL TECHNIQUES AND CORROSION

PART A: ANALYTICAL TECHNIQUES

Conductometric titrations – titrations between strong acid and strong base, strong acid and weak base. Potentiometric titrations (redox titrations). Complexometric titrations using EDTA

PART B: CORROSION

Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, waterline corrosion-passivity of metals-galvanic series - factors influencing rate of corrosion-corrosion control (proper designing, cathodic protection)- Protective coatings: Surface preparation, cathodic and anodic coatings, electroplating, electroless plating (nickel). Paints (constituents, functions, special paints).

UNIT-III : MATERIAL CHEMISTRY

PART A: Non-elemental semiconducting materials: Stoichiometric, controlled valency & chalcogen photo/semiconductors-preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling, epitaxy, diffusion, ion implantation) - Semiconductor devices (p-n junction diode as rectifier, junction transistor).

Insulators: Electrical insulators- applications.

PART B: *Nano materials:* Introduction-sol-gel method- characterization by BET, SEM and TEM methods applications of graphene-carbon nanotubes and fullerenes: Types, preparation and applications Liquid crystals: Introduction-types-applications.
Super conductors: Type –I, Type II-characteristics and applications

UNIT-IV: ADVANCED CONCEPTS/TOPICS IN CHEMISTRY

Computational chemistry: Introduction, Ab Initio studies Molecular switches: characteristics of molecular motors and machines, Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, a molecular elevator, an autonomous light-powered molecular motor

UNIT-V: GREEN CHEMISTRY & NON CONVENTIONAL ENERGY SOURCES

PART A: GREEN CHEMISTRY

Green synthesis: Principles –Applications - 3 or 4 methods of synthesis with examples – R4M4 principles.

PART B: NON CONVENTIONAL ENERGY SOURCES

Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, hydropower, geothermal power, ocean thermal energy conversion, tidal and wave power.

TEXT BOOKS:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co.

REFERENCE BOOKS:

1. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 edition.
2. Engineering Chemistry by Bharathi kumari Yelamanchili, VGS series

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - I

Course Code	Course Name	L	T	P	C
20SH1T06	DIFFERENTIAL EQUATIONS	3	0	0	3

Course Outcomes:
At the end of the Course, the student will be able to
CO1 : Solve the differential equations and apply differential equations related to various engineering fields
CO2 : Solve linear differential equations of second and higher order
CO3 : Calculate Jacobian, maxima and minima of functions of two Variables.
CO4 : Solve first order partial differential equations
CO5 : Solve the higher order partial differential equations

UNIT I: Differential equations of first order and first degree:
Linear differential equations – Bernoulli equations – Exact equations andequations reducible to exact form. Applications: Newton's Law of cooling - Law of natural growth and decay - Orthogonal trajectories.

UNIT II: Linear differential equations of higher order:
Non-homogeneous equations of higher order with constant coefficients with RHS term of the type e^{ax}, sin ax, cos ax, polynomials in x, e^{ax} V(x), $x^nV(x)$- Method of Variation of parameters. Applications: L-R circuit, C-R circuit and L-C-R circuit.

UNIT III: Differential Calculus:
Taylors and Mc Laurent's series for one & two variables – Functional dependence – Jacobian. Applications: Maxima and Minima of functions of two variables with constraints and without constraints.

UNIT IV: **First order Partial differential equations:**
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations

UNIT V: Higher order Partial differential equations:
Solutions of Linear Partial differential equations with constant coefficients – RHS terms of the type eax+by , sin(ax+by), cos(ax+by), xmyn and Method of separation of Variables.

Text Books:
1. B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:
1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, Wiley- India.
2. Dass H.K., Rajnish Verma. Er., Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.
3. Peter O'Neil, Advanced Engineering Mathematics, Cengage

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - I

Course Code	Course Name	L	T	P	C
20ME1T01	ENGINEERING GRAPHICS	1	0	4	3

COURSE OUTCOMES:

At the end of the Course student will be able to:

CO1: To illustrate the fundamental Engineering Drawing Standards and discuss about conics and scales.
CO2: Ability to draw the projection of points and straight lines.
CO3: Ability to draw the projection of planes
CO4: Understand the classification of solids and draw the projection of solids.
CO5: Ability to draw isometric and orthographic projections.

UNIT-I

Introduction to Engineering graphics: Conventions in drawing-lettering - BIS conventions.
Polygons: Constructing regular Polygon by general methods.
Curves: Conic sections in general method and Cycloid, Involutes tangent and normal for the curves
Scales: Plain scales, Diagonal scales and vernier scale.

UNIT-II

Introduction to Orthographic Projections; Projections of Points in various quadrants, Projections of Straight Lines parallel to both planes Projections of Straight Lines-Parallel to one and inclined to other plane
Projections of Straight Lines inclined to both planes, determination of true lengths, angle of inclinations and traces.

UNIT-III

Projections of Planes
Regular Planes Perpendicular / parallel to one Reference Plane and inclined to other Reference Plane, Planes inclined to both the Reference Planes.

UNIT-IV

Projections of solids: Projections of Prisms, Cylinders, with the axis inclined to one Reference Plane. Projections of Pyramids and Cones with the axis inclined to one Reference Plane

UNIT-V

Conversion of isometric views to orthographic views. Conversion of orthographic views to isometric views.

TEXT BOOKS :

1. Elementary Engineering Drawing By N.D.Bhatt, Charotar Publishing House
2. Engineering Drawing, Agarwal & Agarwal, Tata McGraw Hill Publishers.
3. Engineering Drawing, K.L.Narayana& P. Kannaiah, Scitech Publishers.

REFERENCE BOOKS

1. A Text Book of Engineering Graphics By P.J.Shah S.Chand & Company Ltd., New Delhi
2. Engineering Graphics I and II By Arunoday Kumar Tech Max Publication, Pune
3. A text book of Engineering Drawing By P.S.Gill S.K.Kataria & sons, Delhi

DEPARTMENT OF CSE - DATA SCIENCE

SEMESTER - I

Course Code	Course Name	L	T	P	C
20EE1T02	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3

COURSE OUTCOMES:

At the end of the Course, the student will be able to

CO1 : Recognize the fundamentals of solar energy, simple DC and AC circuits.

CO2 : Demonstrate the construction, working principles and operating characteristics of DC machines and transformer

CO3 : Demonstrate the construction, working principles and operating characteristics of AC rotating machines.

CO4 : Demonstrate the working principles and operations of diode rectifiers and transistors

CO5 : Comprehend the concept of working principles and operations of operational amplifiers and CRO.

UNIT-I : DC & AC Fundamentals

Electrical Circuit Elements (R, L and C)-Voltage and Current Sources - Ohms Laws - Kirchoff's Laws - Series-Parallel- Series and Parallel Combination (Only Resistances)-Problems in Simple Circuits with DC Excitation - Representation of Sinusoidal Waveforms - Cycle, Time Period, Frequency, Instantaneous Value, Peak, Average and RMS Values- Phase Angle, Power Factor, Real Power, Reactive Power and Apparent Power (Definition and Simple Problems).

UNIT-II: DC Machines & Transformers

DC Machines: Principle of Operation of DC Generator – EMF Equation – Types of DC Machine – Torque Equation of DC Motor – Applications – Three-Point Starter, Speed Control Methods – OCC Of DC Generator Transformers: Principle of Operation of Single-Phase Transformers – EMF Equation – Losses – Efficiency and Regulation.

UNIT-III : AC Rotating Machines

Principle of Operation of Alternators – Regulation by Synchronous Impedance Method – Principle of Operation Of 3- Phase Induction Motor – Slip-Torque Characteristics - Efficiency – Applications.

UNIT-IV : Rectifiers and Transistors & Concept of Uninterrupted Power Supply (UPS)

PN Junction Diodes – Diode Applications (Half, Full Wave and Bridge Rectifiers) - Zener Diode-Applications (Voltage Regulator) – LED - Photo Diode – SCR- UJT (Principle of Operation)- BJT FET (Types & Principle of Operation)- Concept of UPS-Introduction-Types-Block diagram-applications-Advantages

UNIT-V : Operational Amplifiers and CRO.

Characteristics of Operation Amplifiers (OP-AMP) – Application Of OP-Amps (Inverting, Non-Inverting, Integrator & Differentiator)- Simple Problems on Operation Amplifiers - Cathode Ray Oscilloscope –Construction and Operation.

TEXT BOOKS:

1. D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering, 4th ed., Tata McGraw-Hill, 2019.
2. J. Millman, C. Halkias, Electronic Devices and Circuits, 2nd ed., Tata Mc-Graw-Hill,2008
3. D. Roy Choudhury and Shail B. Jain, Linear Integrated Circuits, 2nd ed., New Age International (p) Ltd, 2004.

REFERENCE BOOKS:

1. P. V. Prasad, S. Sivanagaraju, K. R. Varmah, and Chikku Abraham, Basic Electrical Engineering, 1st ed., Cengage India, 2018.
2. D.C. Kulshreshtha, Basic Electrical Engineering, 1st ed., Revised, Tata McGraw-Hill, 2012.
3. V K Mehta & Rohit Mehta, Principles of Electrical Engineering and Electronics, 3rd ed.,S Chand Publishers, 2019.
4. S. Salivahanan, N. Suresh Kumar, Electronic Devices and Circuits, Tata Mc-Graw Hill Education, 2018.
5. S. Salivahanan, V.S. Kanchana Bhaaskaran, Linear Integrated Circuits, 3rd ed., McGraw-Hill Education, 2018

e-Resources :

1. https://www.slideshare.net/GautamMishra5/ups-uninterrupted-power-supply.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - I

Course Code	Course Name	L	T	P	C
20CS1L01	PROBLEM SOLVING AND PROGRAMMING USING C LAB	0	0	3	1.5

Course Objectives:

- Apply the principles of C language in problem solving.
- To design flowcharts, algorithms and knowing how to debug programs.
- To design & develop of C programs using arrays, strings pointers & functions.
- To review the file operations, preprocessor commands.

Course Outcomes:

At the end of the Course, the student will be able to

CO 1:Gains Knowledge on various concepts of a C language.
CO 2: Draw flowcharts and write algorithms.
CO 3:Design and development of C problem solving skills.
CO 4:Design and develop modular programming skills.
CO 5:Trace and debug a program

Exercise 1:

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.
3. Write a C program to display multiple variables.

Exercise 2:

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r and s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3:

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

Exercise 4:

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5:

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

Exercise 6:

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

Exercise 7:

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

Exercise 8:

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

Exercise 9:

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10:

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

Exercise 11:

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12:

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

Exercise 13:

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.

Exercise 14:

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15:

1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to get the largest element of an array using the function.

Exercise 16:

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to remove a file from the disk

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - I

Course Code	Course Name	L	T	P	C
20CS1L02	IT WORKSHOP	0	0	3	1.5

Course Objectives:
The objective of IT Workshop is to

- Explain the internal parts of a computer, peripherals, I/O ports, connecting cables
- Demonstrate basic command line interface commands on Linux
- Teach the usage of Internet for productivity and self paced lifelong learning
- Demonstrate Office Tools such as Word processors, Spreadsheets and Presentation tools

Course Outcomes:
At the end of the Course, the student will be able to

CO1: Describe evolution of computers, storage devices, networking devices, transmission media and peripherals of a computer .

CO2: Configure, evaluate and select hardware platforms for the implementation and execution of computer applications, services and systems

CO3: Construct a fully functional virtual machine, Summarize various Linux operating system commands.

CO4: Develop presentation, documents and small applications using productivity tools such as word processor, presentation tools, spreadsheets, HTML, LaTex .

COMPUTER HARDWARE:
Experiment 1:
Identification of peripherals of a PC, Laptop, Server and Smart Phones: Prepare a report containing the block diagram along with the configuration of each component and its functionality, Input/ Output devices, I/O ports and interfaces, main memory, cache memory and secondary storage technologies, digital storage basics, networking components and speeds.

OPERATING SYSTEMS:
Experiment 2: Virtual Machine setup:

- Setting up and configuring a new Virtual Machine
- Setting up and configuring an existing Virtual Machine
- Exporting and packaging an existing Virtual Machine into a portable format

Experiment 3: Operating System installation:

- Installing an Operating System such as Linux on Computer hardware.

Experiment 4:Linux Operating System Commands

- General command syntax, Basic help commands, Basic File system commands, Date and Time
- Basic Filters and Text processing, Basic File compression commands
- Miscellaneous: apt-get, vi editor

NETWORKING AND INTERNET

Experiment 5: Networking Commands

ping, ssh, ifconfig, scp, netstat, ipstat, nslookup, traceroute, telnet, host, ftp, arp.

INTERNET SERVICES:

Experiment 6:

- Web Browser usage and advanced settings like LAN, proxy, content, privacy, security, cookies, extensions/ plugins
- Antivirus installation, configuring a firewall, blocking pop-ups
- Email creation and usage, Creating a Digital Profile on LinkedIn

PRODUCTIVITY TOOLS:

OFFICE TOOLS

Experiment 7:

Demonstration and Practice on Text Editors like Notepad++, Sublime Text, Atom, Brackets, Visual code, etc

Experiment 8:

Demonstration and practice on Microsoft Word, Power Point

Experiment 9:

Demonstration and practice on Microsoft Excel.

Experiment 10:

Demonstration and practice on LaTeX and produce professional PDF documents.

Experiment 11:

Internet of Things (IoT): IoT fundamentals, applications, protocols, Architecture, IoT Devices communication models.

INTRODUCTION TO HTML:

Experiment 12:

Understanding HTML tags and creation of simple web pages.

Assignment: Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list.

TEXT BOOKS:

1. Computer Fundamentals, Anita Goel, Pearson Education, 2017
2. PC Hardware Trouble Shooting Made Easy, TMH
3. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr.N.B.Vekateswarlu, S.Chand.
4. HTML & CSS ,The Completee Reference , Fifth Edition , Thomas A. powell
5. LaTeX Companion – Leslie Lamport, PHI/Pearson.

REFERENCE TEXT BOOKS:

1. B. Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance", 2nd edition, Tata McGraw-Hill, 2002
2. "MOS study guide for word, Excel, Powerpoint& Outlook Exams", Joan Lambert, Joyce Cox, PHI.
3. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
4. Bigelows, "Trouble shooting, Maintaining& Repairing PCs", TMH.
5. Excel Functions and Formulas, Bernd held, Theodor Richardson, Third Edition

E-Resources:

1. https://explorersposts.grc.nasa.gov/post631/20062007/computer_basics/ComputerPorts.doc
2. https://explorersposts.grc.nasa.gov/post631/2006-2007/bitsnbyte/Digital_Storage_Basics.doc
3. https://www.thegeekstuff.com/2009/07/linux-ls-command-examples
4. https://www.pcsuggest.com/basic-linux-commands/
5. https://www.vmware.com/pdf/VMwarePlayerManual10.pdf
6. https://gsuite.google.com/learning-center/products/#!/
7. https://www.raspberrypi.org

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - I

Course Code	Course Name	L	T	P	C
20SH1L04	APPLIED CHEMISTRY LAB	0	0	3	1.5

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1 : Estimate unknown solutions by using volumetric titration method.
CO2 : Analyze the quality of water.
CO3 : Determine the p^H of liquid samples.
CO4 : Measure the strength of acids by conduct t to metric and potentiometric titrations.
CO5 : Estimate the acid content in fruit juices and soft drinks.

LIST OF EXPERIMENTS

1. 1.Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis
2. Estimation of HCl using standard Na_2CO_3 solution.
3. Estimation of alkalinity of a sample containing Na_2CO_3 and NaOH.
4. Estimation of total hardness of water using standard EDTA solution.
5. Estimation of copper using standard EDTA solution.
6. Estimation of zinc using standard EDTA solution.
7. Estimation of Ferrous iron using standard K_2Cr_2O7 solution.
8. Estimation of $KMnO_4$ using standard Oxalic acid solution.
9. Estimation of pH of the given sample solution using pH meter.
10. Conduct to metric Titrations between strong acid and strong base.
11. Conduct o metric Titrations between strong acid and Weak base.
12. Preparation of Bakelite.
13. Estimation of acid content in soft drinks.
14. Potentiometric Titrations between ferrous iron with potassium dichromate.
15. Estimation of copper (II) using standard hypo solution.
16. Estimation of iron (III) by colorimetric method

The above experiments at least 10 assessment experiments should be completed in a semester.

Outcomes: The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

Reference Books

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Dr.Bharathi Kumari Yelamanchili - Laboratory Manual of Engineering Chemistry, VGS Techno Series

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - II

Course Code	Course Name	L	T	P	C
20SH2T01	COMMUNICATIVE ENGLISH	3	0	0	3

COURSE OUTCOMES:

CO1 : Recall life in one's past which had fine balancing act.
CO2 : Decide the qualities required to take up a promising career.
CO3 : Evaluate the obstacles hinder of student's progress & find the ways to overcome them.
CO4 : Explain the environment activism and empowerment of women
CO5 : Interpret the efforts of successful persons to keep idealistic approach in achieving goals.

UNIT-I: A Drawer full of happiness

Speaking: Asking and answering general questions on familiar topics such as home, family, work, Study and interests. Self introduction and introduce others.
Vocabulary: Technical vocabulary from a cross technical branches, GRE Vocabulary (Antonyms and Synonyms, Word applications).
Grammar: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns-
Countable and uncountable; singular and plural, basic sentence structures; simple question form –„wh" questions; word order in sentences.
Writing: Note Making and Note Taking.
Employability Skills: Teamwork

UNIT-II: **Nehru's letter to daughter Indira on her Birthday**

Speaking: Discussion in pairs, small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings.
Vocabulary: Technical vocabulary from across technical branches. GRE Vocabulary, Analogies (Antonyms and Synonyms, Word applications)
Grammar: Use of articles and zero article; prepositions.
Writing: Resume, Cover Letter.
Employability Skills: Time Management

UNIT-III: **Stephen Hawking-Positivity 'Benchmark'**

Speaking: Discussing specific topics in pairs or in small groups and reporting what is discussed. Functional English: Complaining and Apologizing.
Reading: Reading a text in detail by making basic inferences-recognizing and interpreting Specific context clues; strategies to use text clues for comprehension. Criticalreading.
Vocabulary: Technical vocabulary from a cross technical branches,GREVocabulary(Antonyms and Synonyms, Word applications) Association, sequencing of words –
Grammar: Verbs– Tenses; subject-verb agreement.
Writing: Letter Writing: -Formal, Business, Editorial, Complaints, Applications, Permissions.
Employability Skills: Leadership skills.

UNIT-IV: Like a Tree, Unbowed: Wangari Maathai-biography

Reading: Studying the use of graphic elements in texts to convey information, reveal trends / patterns / relationships, communicative process or display complicated data.
Reading for Writing: Information transfer; describe, compare, contrast, identify significance / trends based on information provided in figures/charts/graphs/tables.
Vocabulary: Technical vocabulary from across technical branches, GRE Vocabulary,(Antonyms and Synonyms, Word applications) Cloze Encounters.
Writing: Essay Writings: - Paragraph Writing, Precis Writing,
Employability Skills: Management skills.

UNIT-V: Stay Hungry-Stay Foolish

Reading: RAP Strategy Intensive reading and Extensive reading techniques.
Reading for Writing: Writing academic proposals- writing research articles: format and style.
Vocabulary: Technical vocabulary from across technical branches, GRE Vocabulary (Antonyms and Synonyms, Word applications) Coherence, matching emotions.
Grammar: Editing short texts–identifying and correcting common errors in grammar and usage (Articles, prepositions, tenses, subject verb agreement)
Writing: E- Mail, Reports, Reporting to media.
Employability Skills: Creative Thinking.

TEXT BOOKS:

1. "Infotech English", Maruthi Publications.

REFERENCE BOOKS:

1. Bailey, Stephen.Academicwriting:Ahandbookforinternationalstudents.Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. SkillfulLevel2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin.Cambridge Academic English (B2).CUP,2012.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - II

Course Code	Course Name	L	T	P	C
20SH2T02	APPLIED PHYSICS	3	0	0	3

COURSE OUTCOMES:

After successful completion of this course, students should be able to

CO1: Explain the need of coherent sources and the conditions for sustained interference.
CO2: Understand the basic concepts of LASER light Sources
CO3: Analyze the physical significance of wave function.
CO4: Identify the type of semiconductor using Hall effect.
CO5: Apply the concept of magnetism to magnetic devices

UNIT-I : WAVE OPTICS

INTERFERENCE: Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications -Colors in thin films- Newton's Rings- Determination of wavelength and refractive index.

DIFFRACTION: Introduction - Fresnel and Fraunhofer diffraction - Fraunhofer diffraction due to single slit, double slit - N-slits(Qualitative) – Grating - Dispersive power and resolving power of Grating(Qualitative).

POLARIZATION: Introduction-Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT-II LASERS & FIBER OPTICS

LASERs: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation- Einstein's coefficients – Population inversion –Lasing action- Pumping mechanisms – Ruby laser – He-Ne laser - Applications of lasers.

FIBER OPTICS: Introduction –Principle of optical fiber- Acceptance Angle-Numerical Aperture-Classification of optical fibers based on refractive index profile and modes –Propagation of electromagnetic wave through optical fibers - Applications.

UNIT-III MAGNETISM & DIELECTRICS

MAGNETISM: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment - Bohr magneton- Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism – Hysteresis – soft and hard magnetic materials – applications of Ferromagnetic material.

DIELECTRICS: Introduction - Dielectric polarization-Dielectric polarizability, Susceptibility and Dielectric constant - Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Lorentz Internal field-Claussius –Mossotti's equation- Frequency dependence of polarization - Applications of dielectrics.

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UNIT-IV : QUANTUM MECHANICS , FREE ELECTRON THEORY & BAND THEORY OF SOLIDS

Introduction – matter waves – de Broglie's hypothesis, Heisenberg's Uncertainty Principle Schrödinger time independent and time dependent wave equations – physical significance of Schrödinger wave function – Particle in a potential box (determination of energy).

FREE ELECTRON THEORY: Introduction - Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory- Equation for electrical conductivity based on quantum free electron theory-Fermi-Dirac distribution- Density of states (3D) – Fermi energy

BAND THEORY OF SOLIDS:

Introduction - Bloch thorem, krong-Penney model, E vsK diagram, effective mass of electron, classification of c solids –concept of hole.

UNIT – V : SEMICONDUCTOR PHYSICS

Introduction – Intrinsic semiconductors - density of charge carriers – Electrical conductivity - Fermi level - extrinsic semiconductors - P-type & N-type - Density of charge carriers - Dependence of Fermi energy on carrier concentration and temperature- Drift and Diffusion currents - Einstein's equation. Hall effect- Hall coefficient - Applications of Hall effect.

TEXT BOOKS:

1. B. K. Pandey, S. Chaturvedi .,"Engineering Physics" - Cengage Publications, 2012
2. M.N. Avadhanulu, P.G.Kshirsagar., "A Text book of Engineering Physics" - S.Chand, 2017.
3. D.K.Bhattacharya and Poonam Tandon., "Engineering Physics", Oxford press (2015).
4. R.K Gaur. and S.L Gupta., "Engineering Physics" - Dhanpat Rai publishers, 2012.

REFERENCE BOOKS:

1. M.R.Srinivasan, "Engineering Physics", New Age international publishers (2009).
2. Ajoy Ghatak "Optics", 6th Edition McGraw Hill Education, 2017.
3. A.J.Dekker "Solid State Physics", Mc Millan Publishers (2011).

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - II

Course Code	Course Name	L	T	P	C
20SH2T07	LINEAR ALGEBRA & VECTOR CALCULUS	3	0	0	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1 : Solve simultaneous linear equations numerically using various matrix methods.

CO 2 : Find the Eigen values and Eigen vectors of a given matrix and nature of quadratic form.

CO 3 : Determine double integral over a region and triple integral over a volume.

CO 4 : Calculate gradient of a scalar function, divergence and curl of a vector function.

CO5 : Determine line, surface and volume integrals and apply Green, Stokes and Gauss divergence theorems to calculate line, surface and volume integrals.

UNIT I: Linear systems of equations:

Rank - Echelon form – Normal form – Solving system of homogeneous and Non– Homogeneous equations – Gauss elimination – Gauss Jordon. Applications: Finding the current in electrical circuits.

UNIT II: Eigen values - Eigen vectors and Quadratic forms:

Eigen values – Eigen vectors– Properties (without proof) – Clayey-Hamilton theorem (Without of proof) – Inverse and powers of a matrix by using Clayey-Hamilton theorem– Diagonalisation – Reduction of quadratic form to canonical form by Orthogonalisation – Rank – Positive, negative and semi definite – Index – Signature.

UNIT III: Multiple integrals:

Double and Triple integrals – Change of order of integration – Change of variables. Applications: Finding Areas.

UNIT IV: Vector Differentiation:

Gradient– Directional derivative – Divergence – Curl – Scalar Potential – Laplacian and second order operators -Vector identities.

UNIT V: Vector Integration

Line integral – Work done – Potential function – Surface and volume integrals – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) .

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw HillEducation.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Dass H.K., Rajnish Verma. Er.,** Higher Engineering Mathematics, S. Chand Co.Pvt. Ltd, Delhi

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - II

Course Code	Course Name	L	T	P	C
20EC2T01	DIGITAL LOGIC DESIGN	3	0	0	3

COURSE OUTCOMES:

At the end of the Course, the student will be able to

CO1 : Define different number systems and recognize various applications of it.
CO2 : Select the concept of Boolean algebra in minimization and identify the solution of switching functions.
CO3 : Execute different types of combinational logiccircuits.
CO4 : Execute the PLA logic for different applications
CO5 : Use knowledge of flip-flops in operation of Registers andcounters

UNIT-I: NUMBER SYSTEMS & CODES:

Review of number systems, conversions, r's and r-1's complements of signed numbers, arithmetic addition and subtraction, Gray code, 4-bit codes, Error detection and correction codes.

UNIT-II: BOOLEAN THEOREMS &MINIMIZATION TECHNIQUES

Boolean theorems, representations of Boolean functions, logic gates, NAND-NAND and NOR-NOR realizations, Minimization of switching functions using Boolean theorems, K-map (up to 5 variables) and tabular method, with & without Don't-care conditions.

UNIT-III: COMBINATIONAL LOGIC CIRCUIT DESIGN

Analysis and design procedure of combinational logic circuits: Half-adder, Full-adder, Half-subtractor, Full-subtractor, 4-bit adder-subtractor, Decoders, Encoders, Multiplexers, De-Multiplexers, comparator, code converts.

UNIT-IV: INTRODUCTION OF PROGRAMMABLE LOGIC DEVICES

PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions, Programming table, memory types

UNIT-V: SEQUENTIAL LOGIC CIRCUIT DESIGN

Introduction to Sequential Circuits, Storage Elements: Latches, Flip-Flops: RS, JK, D and T flip-flops truth and excitation tables, conversion of flip-flops. Registers, shift registers, Counters: synchronous and asynchronous.

TEXT BOOKS:

1. M.Morris Mano, Digital Design, 4th Edition, PHI Publication, 2008.
2. A. Anand Kumar, Fundamentals of digital circuits, 4th Edition, PHI Publication, 2016.

REFERENCE BOOKS:

1. Norman Balabanian and Bradley Carlson, Digital Logic Design Principles 1st Edition,Wiley Publisher, 2010
2. John P.Hayes, Introduction to Digital Logic Design, 1st Edition, Pearson Publication,1993.
3. AlamMansaf and Alam Bashir, Digital Logic Design, PHI Publication, 2015.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - II

Course Code	Course Name	L	T	P	C
20CS2T01	PYTHON PROGRAMMING	3	0	0	3

Course Objectives:
The Objectives of Python Programming are

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops &functions
- To be familiarized with general coding techniques and object-oriented programming

Course Outcomes:
At the end of the Course, the student will be able to
CO1: Develop essential programming skills in computer programming concepts like data types, containers
CO2: Apply the basics of programming in the Python language
CO3: Solve coding tasks related conditional execution, loops
CO4: Solve coding tasks related to the fundamental notions and techniques used in object-oriented programming.

UNIT I
Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.
Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets.
Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.
Programming: Introduction to Programming Concepts with Scratch.

UNIT II
Repetition Structures: Introduction, while loop, for loop, Nested Loops.
Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration The While Loop
Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods TextFiles, string pattern matching. Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

UNIT III

List and Dictionaries: Lists, tuple, Dictionaries and sets, frozen sets.

Design with Function: Defining Simple Functions, Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Managing a Program's Namespace, Higher Order Function.

Modules: Modules, Standard Modules, Packages.

UNIT IV

Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support.

Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism.

UNIT V

Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions.

Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUIResources, Turtle Graphics

Testing: Basics of testing? unit testing in python, writing test cases, running tests.

Text Books

1) Fundamentals of Python First Programs, Kenneth. A. Lambert,Cengage.
2) Python Programming: A Modern Approach, VamsiKurama,Pearson.
3) ReemaThareja, Python Programming using problem solving Approach, Oxford University Press 2017
4) R. NageswaraRao core python Programming second Edition.

Reference Books:

1) Introduction to Python Programming, Gowrishankar.S, VeenaA, CRC Press.
2) Introduction to Programming Using Python, Y. Daniel Liang,Pearson.

E - Resources:

1. https://www.tutorialspoint.com/python3/python_tutorial.pdf
2. https://bugs.python.org/file47781/Tutorial_EDIT.pdf

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - II

Course Code	Course Name	L	T	P	C
20SH2L01	ENGLISH COMMUNICATIVE SKILL LAB	0	0	3	1.5

Module - I:

Introduction to Phonetics.

a) Brief Introduction to Consonants
b) Brief Introduction to Vowels & Diphthongs

Module - II:

Listening Comprehension

a) Comprehending Spoken material in British English.
b) Comprehending Spoken material in American English.
c) Intelligent Listening in Situations.

Module -III:

Role – Play / Dialogue Writing

a) Introducing one and others.
b) Asking for and giving information.
c) Asking for and responding to give directions.
d) Seeking permission, requests.
e) Apologizing.

Module - IV:

Communication Skills

a) Verbal and Non – verbal communications
b) Barriers of communication.
c) Body Language – Voluntary and Involuntary.

Module - V:

Presentation Skills.

a) Extempore
b) JAM Sessions
c) Paper Presentation

Module - VI:

a) Group Discussions: Dos and Don'ts- Types, Modalities

Resume Preparation

References:

1. Infotech English, Maruthi Publications (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.
8. Technical Communication- Meenakshi Raman, Sangeeta Sharma, Oxford University Press.
9. Technical Communication- Gajendrea Singh Chauhan, SmitaKashiramka, Cengage Publications.

DEPARTMENT OF CSE - DATA SCIENCE

SEMESTER - II

Course Code	Course Name	L	T	P	C
20SH2L02	APPLIED PHYSICS LAB	0	0	3	1.5

COURSE OUTCOMES:

At the end of the Course, the student will be able to

CO1 : **Memorize** the conditions for sustained Interference and Diffraction.

CO2 : **Understand** the basic concepts of LASER.

CO3 : **Identify** the properties of various materials.

CO4 : **Apply** the concept of dielectrics on the materials.

CO5 : **Analyze** the acoustic properties of sound.

List of Experiments :

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence.
2. Newton's rings – Radius of Curvature of Plano - Convex Lens.
3. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
4. Energy Band gap of a Semiconductor p - n junction
5. Characteristics of Thermistor – Temperature Coefficients
6. Determination of dielectric constant.
7. LASER - Determination of wavelength by plane diffraction grating
8. Rigidity modulus of material by wire-dynamic method (Torsional pendulum)
9. Verification of laws of vibrations in a stretched string – Sonometer
10. LASER - Determination of particle size using laser.
11. Determination of moment of inertia of a fly wheel.
12. Melde's Experiment – Transverse and longitudinal waves
13. Determination of time constant – C- R Circuit.
14. I/V Characteristics of ZENAR diode.
15. Determination of Young's Modules of the given Beam – Cantilever.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - II

Course Code	Course Name	L	T	P	C
20CS2L01	**PYTHON PROGRAMMING LAB**	**0**	**0**	**3**	**1.5**

Course Objectives:

The aim of Python Programming Lab is

- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python
- To develop the skill of designing Graphical user Interfaces in Python
- To develop the ability to write database applications in Python

Course Outcomes*:*

At the end of the Course, the student will be able to

CO 1: Write, Test and Debug Python Programs

CO 2: Use Conditionals and Loops for Python Programs

CO 3: Use functions and represent Compound data using Lists, Tuples and Dictionaries

CO 4: Use various applications using python

1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
2) Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
3) Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86,89.
4) Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.
5) Use a *for* loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.

```
*
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***
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6) Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
7) Write a program that asks the user for two numbers and prints *Close* if the numbers are within .001 of each other and Not closeotherwise.
8) Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
9) Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters *abcde* and *ABCDE* the program should print out *AaBbCcDdEe*
10) Write a program that asks the user for a large integer and inserts commas into it according

to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be1,000,000.

11) Write a program that generates a list of 20 random numbers between 1 and100.
12) Print the list.
13) Print the average of the elements in the list.
14) Print the largest and smallest values in the list.
15) Print the second largest and second smallest entries in the list
16) Print how many even numbers are in the list.
17) Write a program to use split and join methods in the given string and store them in a dictionary data structure.
18) Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0].
19) Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometres. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements, it is much shorter with lists and it is also easier to add new conversions if you use lists.
20) Write a function called *sum_digits*that is given an integer num and returns the sum of the digits of num.
21) Write a function called *first_diff*that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return-1.
22) Write a function called *number_of_factors*that takes an integer and returns how many factors the number has.
23) Write a function called *is_sorted*that is given a list and returns True if the list is sorted and False otherwise.
24) Write a function called root that is given a number x and an integer n and returns x1/n. In the function definition, set the default value of n to 2.
25) Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
    (a)Do this using the sort method. (b) Do this without using the sort method
26) Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.
27) Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.
28) Write a program that reads a list of temperatures from a file called *temps.txt*, converts those temperatures to Fahrenheit, and writes the results to a file calledftemps.txt.
29) Write a class called Product. The class should have fields called name, amount, and price, holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price*that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10

and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase*that receives the number of items to be bought and decreases amount by thatmuch.

30) Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes*that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called *convert_to_hours*that returns a string of hours, minutes, and seconds formatted analogously to the previous method.
31) Write a Python class to implement pow(x,n).
32) Write a Python class to reverse a string word byword.
33) Write a program to demonstrate Try/except/else.
34) Write a function nearly _equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.
35) Write a python program to create wheel using turtle graphics.
36) Write a python program on GUI to create a Registration form.
37) Write a python program to check whether a string starts and ends with the same character or not (using Regular Expression re module).

Text Books

1) Fundamentals of Python First Programs, Kenneth. A. Lambert,Cengage.
2) Python Programming: A Modern Approach, VamsiKurama,Pearson.
3) ReemaThareja, Python Programming using problem solving Approach, Oxford University Press 2017
4) R. NageswaraRao core python Programming second Edition.

Reference Books:

1) Introduction to Python Programming, Gowrishankar.S, VeenaA, CRC Press.
2) Introduction to Programming Using Python, Y. Daniel Liang,Pearson.

E-Resources:

1) https://www.tutorialspoint.com/python3/python_tutorial.pdf
2) https://bugs.python.org/file47781/Tutorial_EDIT.pdf

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - II

Course Code	Course Name	L	T	P	C
20GE2M01	ENVIRONMENTAL SCIENCES	2	0	0	0

COURSE OUTCOMES:

After successful completion of this course, students will be able to

CO1 : Identify the fundamental concepts and the first global initiatives towards sustainable development and the possible means to combat the challenges

CO2 : Examine the natural resources, their availability for the sustenance of the life and recognize the need to promote the green technologies to conserve the natural resources

CO3 : Assess the concepts of the ecosystem, its function in the environment and the need for protecting various ecosystems
Discuss the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity

CO4 : Explain various attributes of the pollution and their impacts and measures to control the pollution along with waste management practices

CO5 : Outline the social issues including the environmental legislations of India and environmental assessment and also to investigate the industrial, urban and rural conditions in the surroundings.

UNIT I: Scope and Importance of Environmental Studies

Definition and components of environment, Scope and Importance: Sustainability: Stockholm and Rio Summit: Global Environmental Challenges: Global warming and climate change- Acid rains, Ozone layer depletion, Population Explosion and effects, Role of IT in environmental protection and human health.

UNIT-II: Natural Resources and associated problems

Forest resources – Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people

Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems,

Energy resources: Growing energy needs, renewable and non-renewable energy sources

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification.

UNIT-III: Ecosystems and Biodiversity and its conservation

Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem –Bio geo chemical cycles-Ecological succession. – Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

Green Campus and Green Energy. Identification of species by involving in activities like plantation inside or outside the campus.

Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity - classification - Value of biodiversity: consumptive use, productive use, social- India as a mega-diversity nation - Hot-spots of biodiversity- Threats to biodiversity: habitat loss, man-wildlife conflicts - Endangered and endemic species of India – Conservation of biodiversity.

UNIT-IV: Environmental Pollution

Definition, Cause, effects and control measures of **Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards**. Role of an individual in prevention of pollution. - Pollution case studies,

Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management. Industrial Disasters and Pollution Case studies: -Bhopal Disaster, Chernobyl accident, Love canal Disaster.

UNIT-V: Environmental Legislation and the Environmental Management

Environmental Protection Act –Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness

Impact Assessment and its significance-various stages of EIA, preparation of EMP and EIS, Eco-tourism.

Visit to an Industry / Urban/Rural/Agricultural Ecosystem and submit a report individually on any issues or Documentation of Plants and Animals (Field work Equal to 3 lecture hours).

TEXT BOOKS:

1. Environment Studies, Fourth Edition, Anubha Kaushik, C P Kaushik, New Age International Publishers.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi.
3. Fundamentals of Environment Studies, MahuaBasu and S.Xavier, Cambridge Publishers, 2014.
4. Textbook of Environmental Science, M. Anji Reddy, B S Publications, Hyderabad

REFERENCE BOOKS:

1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, NewDelhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, NewDelhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New AgeInternational Publishers,2014

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
20SH3T05	PROBABILITY & STATISTICS	3	0	0	3

Course Objectives:

- To familiarize the students with the foundations of probability and statistical methods
- To impart probability concepts and statistical methods in various applications Engineering

Course Outcomes:

At the end of the Course, the student will be able to

CO1 : Determine the mean and variance of discrete and continuous random variables.

CO2 : Calculate probabilities using normal distribution and construct sampling distribution of means.

CO3 : Estimate the confidence interval for the mean of a population and test a hypothesis concerning means.

CO4: Estimate the confidence intervals, test a hypothesis concerning variances and proportions.

CO5 : Calculate correlation coefficient and determine line a regression for bivariate data.

Unit I:

Random Variables: Random variables, types of random variables, probability distribution function, probability density function, mean and variance of a random variable

Unit II:

Probability Distributions and Sampling Distributions:

Normal distribution: calculating normal probabilities, normal approximation to the Binomial distribution. Sampling distributions: population and sample, sampling distribution of the mean (known), sampling distribution of the mean (unknown).

Unit III:

Estimation and Test of Hypothesis of Means :

Point estimation, interval estimation, introduction to test of hypothesis, hypotheses is concerning one mean, hypothesis concerning two means, matched pair comparisons.

Unit IV:

Estimation, Test of Hypothesis of Variances and Proportions Estimation of variance, hypothesis concerning one variance, hypothesis concerning two variances, estimation of proportion, hypothecs is concerning one proportion, hypotheses is concerning several proportions.

Unit V:

Regression analysis:

The method of least squares, curvilinear regression, multiple regression, correlation (excluding causation).

Text book:

1. Richard A. Johnson,"*Miller & Freund's Probability and Statistics for Engineers*", 8th edition, PHIL earning India Private Limited, 2011.

Reference Books:

1) S.Ross,"*A First Coursein Probability*", Pearson Education India, 2002.
2) W. Feller, "*An Introduction to Probability Theory and its Applications*", 1st edition, Wiley,1968.
3) Gilbert Strang, "*Introduction to Linear Algebra*", 5thedition, Wellesely- Cambridge Press, 2016.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
20CS3T04	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE	3	0	0	3

Course Objectives:

This course is designed to:

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning
- To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science

Course Outcomes:

At the end of the course student will be able to

CO1 : Demonstrate skills in solving mathematical problems.
CO2: Comprehend mathematical principles and logic.
CO3: Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software.
CO4: Manipulate and analyze data numerically and/or graphically using appropriate Software.
CO5: Communicate effectively mathematical ideas/results verbally or in writing.

UNIT I

Mathematical Logic: Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT II

Set Theory: Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hassie Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties, Algebraic Structures:Algebraic Systems, Properties, Semi Groups and Monoids, Group, Subgroup and Abelian Group, Homomorphism, Isomorphism.

UNIT III

Combinatorics: Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems, Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat's and Euler's Theorems.

UNIT IV

Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations.

UNIT V

Graph Theory: Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

Text Books:

1) Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P.Manohar, Tata McGraw Hill.
2) Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra,3rdEdition, Tata McGraw Hill.

Reference Books:

1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P.Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.
3. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

E-Resources:

1) https://nptel.ac.in/courses/106/106/106106094/

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
20CS3T05	DATA STRUCTURES & ALGORITHMS	3	0	0	3

COURSE OUTCOMES:

At the end of the Course the student shall be able to

CO 1: Analyse algorithms and Describe searching, sorting and hashing techniques.
CO 2: Describe the concepts of stacks and queues.
CO 3: Apply the concepts of linked lists.
CO 4: Describe the concepts of trees.
CO 5: Explain the concepts of graphs

UNIT-I: **Analysis of Algorithms:** Efficiency of algorithms, A priori Analysis, Asymptotic notations, Time complexity of algorithms using Onotation, Polynomial Vs Exponential algorithms, Average, Best, Worst case complexities, Analysing recursive programs.
Searching: Introduction, Linear Search, Binary Search, Fibonacci Search.
Internal Sorting: Introduction, Bubble Sort, Insertion Sort, Selection Sort.
Hashing : Introduction, Hash Table Structure, Hash Functions

UNIT-II: Stacks: Introduction, Stack operations, Applications.
Queues : Introduction, Operations on queues, circular queues, Priority queues, Applications

UNIT-III
Linked Lists: Introduction, Singly linked lists, Circular linked lists, Doubly linked lists, Multiple linked lists, Applications.
Linked Stacks and Linked Queues: Introduction, Operations on linked stacks and linked queues, Dynamic memory management, Implementation of linked representations, Applications

UNIT-IV: Trees and Binary Trees: Introduction, Trees: Definition and Basic Terminologies, Representation of trees. Binary trees: Basic terminologies and types, representation of binary trees, binary tree traversals, applications.
Binary Search Trees and AVL Trees : Introduction, Binary search trees: Definition and operations, AVL Trees: Definition and operations, Applications

UNIT-V
Graphs: Introduction, Definitions and basic terminologies, Representations of graphs, Graph traversals and applications.

TEXT BOOKS:

1. Data Struct & Algorithm Analysis in C | Second Edition | Mark Allen Weiss |by Pearson
2. Data Structures using C |Second Edition| by Reema Thareja| Oxford

REFERENCES:

1. G.A.V. PAI, *Data Structures and Algorithms, Concepts, Techniques and Applications*,Volume1,1st Edition , TataMcGraw-Hill,2008.
2. Richard F. Gilberg & Behrouz A. Forouzan, *Data Structures, Pseudo code Approach withC*,2nd Edition, CengageLearningIndiaEdition,2007.
3. angsam,M.J.Augenstein,A.M.Tanenbaum,*Data structure susing C and C++*, 2nd Edition, PHIE ducation, 2008.
4. Sartaj Sahni, Ellis Horowitz, *Fundamentals of Data Structures in C*, 2nd Edition, Orient blacks wan, 2010.

E- REFERENCES:

1. https://www.javatpoint.com/data-structure-tutorial

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
20CD3T01	FUNDAMENTALS OF DATA SCIENCE	3	0	0	3

Course Objectives:

- To provide a comprehensive knowledge of data science using Python.
- To learn the essential concepts of data analytics and data visualization

Course Outcomes:

At the end of the Course, the student will be able to

CO1 : Apply principles of NumPy and Pandas to the analysis of data.
CO2 : Make use of various file formats in loading and storage of data.
CO3 : Identify and apply the need and importance of pre-processing techniques.
CO4 : Show the results and present them in a pictorial format.

UNIT I

Data science: definition, Datafication, Exploratory Data Analysis, The Data science process, A data scientist role in this process.

NumPy Basics: The NumPy ndarray: A Multidimensional Array Object, Creating nd arrays ,Data Types for nd arrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.

UNIT II

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, Data Frame, Index Objects, Essential Functionality Re indexing, Dropping entries from an axis, Indexing, selection, and filtering),Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.

UNIT III

Data Loading, Storage, and File Formats : Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats, Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Databases, Storing and Loading Data in MongoDB

UNIT IV

Data Wrangling: Combining and Merging Data Sets, Database style Data Frame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap , Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Data Transformation, Removing Duplicates, Replacing Values.

UNIT V

Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File,Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots.

Text Books :

1. Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013

Reference Books:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015
2. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
20CS3T01	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

Course Objectives:

- To introduce about database management systems
- To give a good formal foundation on the relational model of data and usage of Relational Algebra
- To introduce the concepts of basic SQL as a universal Database language
- To demonstrate the principles behind systematic database design approaches by covering conceptualdesign, logical design through normalization
- To provide an overview of physical design of a database system, by discussing Database indexingtechniques and storage techniques

Course Outcomes:

At the end of the Course, the student will be able to

CO1 : Describe a relational database and object-oriented database
CO2 : Create, maintain and manipulate a relational database using SQL
CO3: Describe ER model and normalization for database design
CO4 : Examine issues in data storage and query processing and can formulate appropriate solutions
CO5: Outline the role and issues in management of data such as efficiency, privacy, security, ethicalresponsibility, and strategic advantage

UNIT I

Introduction: Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure.

UNIT II

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance **BASIC SQL**: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).

UNIT III

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. **SQL**: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV

Schema Refinement (Normalization):Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V

Transaction Concept: Introduction of Transaction Processing, DBMS Buffers, Concurrency control, Types of Failures, Transaction states and Operations, System log, Transaction Properties, Schedules and Types of Schedules.

Indexing Techniques: File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing: Tree base Indexing, Comparison of File Organizations.

Text Books:

1) Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH
2) Database System Concepts,5/e, Silberschatz, Korth, TMH

Reference Books:

1) Introduction to Database Systems, 8/e C J Date, PEA.
2) Database Management System, 6/e RamezElmasri, Shamkant B. Navathe, PEA
3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel,Steven Morris, Peter Robb, Cengage Learning.

e-Resources:

1) https://nptel.ac.in/courses/106/105/106105175/
2) https://www.geeksforgeeks.org/introduction-to-nosql/

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
20CD3L01	FUNDAMENTALS OF DATA SCIENCE LAB	0	0	3	1.5

Course Objectives:
The main objective of the course is to inculcate the basic understanding of Data Science and it's practicalimplementation using Python.

Course Outcomes:
At the end of the Course, the student will be able to
CO1 : Perform various operations on numpy arrays
CO2 : Importing data from different file formats using pandas
CO3 : Draw different types of charts using matplotlib

List of Experiments :
1. Creating a NumPy Array
   a. Basic ndarray
   b. Array of zeros
   c. Array of ones
   d. Random numbers in ndarray
   e. An array of your choice
   f. Imatrix in NumPy
   g. Evenly spaced ndarray

2. The Shape and Reshaping of NumPy Array
   a. Dimensions of NumPy array
   b. Shape of NumPy array
   c. Size of NumPy array
   d. Reshaping a NumPy array
   e. Flattening a NumPy array
   f. Transpose of a NumPy array

3. Expanding and Squeezing a NumPy Array
   a. Expanding a NumPy array
   b. Squeezing a NumPy array
   c. Sorting in NumPy Arrays

4. Indexing and Slicing of NumPy Array
   a. Slicing 1-D NumPy arrays
   b. Slicing 2-D NumPy arrays
   c. Slicing 3-D NumPy arrays
   d. Negative slicing of NumPy arrays

5. Stacking and Concatenating Numpy Arrays
   a. Stacking ndarrays
   b. Concatenating ndarrays
   c. Broadcasting in Numpy Arrays

6. Perform following operations using pandas
   a. Creating dataframe
   b. concat()
   c. Setting conditions
   d. Adding a new column

7. Perform following operations using pandas
   a. Filling NaN with string
   b. Sorting based on column values
   c. groupby()

8. Read the following file formats using pandas
   a. Text files
   b. CSV files
   c. Excel files
   d. JSON files

9. Read the following file formats
   a. Pickle files
   b. Image files using PIL
   c. Multiple files using Glob
   d. Importing data from database
10. Demonstrate web scraping using python
11. Perform following preprocessing techniques on loan prediction dataset
   a. Feature Scaling
   b. Feature Standardization
   c. Label Encoding
   d. One Hot Encoding

12. Perform following visualizations using matplotlib
   a. Bar Graph
   b. Pie Chart
   c. Box Plot
   d. Histogram
   e. Line Chart and Subplots
   f. Scatter Plot

Web References:

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration- python/

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
20CS3L03	DATA STRUCTURES & ALGORITHMS LAB	0	0	3	1.5

Course Outcomes:
At the end of the Course the student shall be able to
CO1:Apply recursive and iterative methodologies to solve complex engineering problems.
CO2: Solve searching and sorting techniques and evaluate time & space complexities.
CO3: Develop solutions to create and implement operations of linear and nonlinear data structures.
CO 4:Identify and apply suitable data structure for a given real time problem

List of Experiments:
Exercise 1:
a) Write a recursive C program to calculate Factorial of an integer.
b) Write a recursive C program which computes the n^{th} Fibonacci number, for appropriate values of n.

Exercise 2:
a) Write a recursive C program to calculate GCD (n, m).
b) Write a recursive C program for Towers of Hanoi: N disks are to be transferred from peg S to peg D with Peg I as the intermediate peg.

Exercise 3:
a) Write a C program that implements Selection sort, to sort a given list of integers in ascending order.
b) Write a C program that implements Insertion sort, to sort a given list of integers in ascending order.

Exercise 4:
a) Write a C program that implements Quick sort, to sort a given list of integers in ascending order.
b) Write a C program that implements Radix sort, to sort a given list of integers in ascending order.
c) Write a C program that implements Merge sort, to sort a given list of integers in ascending order.

Exercise 5:
a) Write a C program that implements Stack (its operations) using arrays.
b) Write a C program that uses Stack operations to convert infix expression into postfix expression

Exercise 6:

a) Write a C program that implements Queue (its operations) using arrays.
b) Write a C program that implements Circular Queue (its operations) using arrays.

Exercise 7:

a) Write a C program that uses functions to create a singly linked list and its operations(insert, delete, search).
b) Write a C program to reverse elements of a singly linked list.

Exercise 8:

a) Write a C program that implements Stack (its operations) using Linked list.
b) Write a C program that implements Queue (its operations) using Linked list.

Exercise 9:

a) Write a C program to create a Circular Linked list and its operations(insert, delete, search).
a) Write a C program to create a Doubly Linked list and its operations(insert, delete, search).

Exercise 10:

a) Write a C program to create a Binary Search Tree and its operations.
b) Write a recursive C program for traversing a Binary Search Tree in preorder, inorder and postorder.

Exercise 11:

a) Write a C program to perform BFS traversal on given graph.
b) Write a C program to perform DFS traversal on given graph.

TEXT BOOKS:

1. Richard F, Gilberg, Forouzan, Data Structures, 2nd edition, Cengage
2. Aaron M. Tenenbaum, YedidyahLangsam, Moshe J Augenstein, Data Structures usingC, Pearson.
3. Mark Allen Weiss, Data structures and Algorithm Analysis in C, 2nd edition, Pearson Education. Ltd.

REFERENCE BOOKS:

1. Jean-Paul Tremblay Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd edition, Mc Graw Hill Higher Education
2. Seymour Lipschutz, Data Structure with C, TMH
3. ReemaThareja, Data Structures using C, 2nd edition, Oxford

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
20CS3L01	DATABASE MANAGEMENT SYSTEMS LAB	0	0	3	1.5

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers

Course Outcomes:

At the end of the Course, the student will be able to

CO1 : Utilize SQL to execute queries for creating database and performing data manipulation Operations.

CO2 : Examine integrity constraints to build efficient databases

CO3 : Apply Queries using Advanced Concepts of SQL

CO4 : Build PL/SQL programs including stored procedures, functions, cursors and triggers

List of Exercises:

1. Creation, altering and droping of tables and inserting rows into a table (use constraints while creatingtables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example: Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5.
    i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printedfor those who secured first class and an exception can be raised if no records were found)
    ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression.The program can be extended using the NULLIF and COALESCE functions
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION

ERROR.

8. Programs development using creation of procedures, passing parameters IN And OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements andwrite complex functions
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERECURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and non-indexingtechniques.

Text Books/Suggested Reading:

1) Oracle: The Complete Reference by Oracle Press
2) Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3) Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER – III

Course Code	Course Name	L	T	P	C
20CS3S01	MOBILE APP DEVELOPMENT	1	0	2	2

Course Objectives:

- To understand the components and structure of mobile application development frameworks forAndroid and windows OS based mobiles.
- To understand how to work with various mobile application development frameworks.
- To learn the basic and important design concepts and issues of development of mobile applications.
- To understand the capabilities and limitations of mobile devices.

Course Outcomes:

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

CO1: Identify various concepts of mobile programming that make it unique from programming for other Platforms.

CO2: Critique mobile applications on their design pros and cons

CO3: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,

CO4: Program mobile applications for the Android operating system that use basic and advanced phone features and Deploy applications to the Android marketplace for distribution.

LIST OF EXPERIMENTS:

1. Introduction to mobile technologies and devices , Android platform and applications overview
2. Setting Android development environments
3. Writing Android applications, Understanding anatomy of an Android application
4. Develop an application that uses GUI components, Font and Colours
5. Develop an application that uses Layout Managers and event listeners.
6. Write an application that draws basic graphical primitives on the screen.
7. Develop an application that makes use of databases.
8. Develop an application that makes use of Notification Manager
9. Implement an application that uses Multi-threading
10. Develop a native application that uses GPS location information
11. Implement an application that writes data to the SD card.
12. Implement an application that creates an alert upon receiving a message
13. Write a mobile application that makes use of RSS feed
14. Develop a mobile application to send an email.
15. Develop a Mobile application for simple needs (Mini Project)

References:

1. Android Programming unleashed , B.M. Harwani, Pearson, 2013.
2. Android Programming (Big Nerd Ranch Guide), by Bill Phillips, Chris Stewart, Brian Hardy, Kristin Marsicano, Pearson, 2016
3. Android Programming – Pushing the limits by Hellman by Erik Hellman, WILEY, 2013

Web References:

1. The Complete Android N Developer Course –Udemy https://www.udemy.com/course/complete-android-n-developer-course/?altsc=428526
2. Android Development Courses on Google developers training https://developers.google.com/training/android/
3. Mobile Computing - Video course- NPTEL https://nptel.ac.in/courses/106/106/106106147/#
4. Android Tutorial – Tutorial Point https://www.tutorialspoint.com/android/index.htm

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
20GE3M01	CONSTITUTION OF INDIA	2	0	0	0

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court andhigh court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative

Course Outcomes:

At the end of the Course, the student will be able to

CO1 : Understand historical background of the constitution making and its importance for building a democratic India.

CO2 : Understand the functioning of three wings of the government ie., executive, legislative and judiciary

CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India.

CO4 : Analyze the decentralization of power between central, state and local self-government.

CO5 : Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

1. Know the sources, features and principles of Indian Constitution.
2. Learn about Union Government, State government and its administration.
3. Get acquainted with Local administration and Pachayati Raj.
4. Be aware of basic concepts and developments of Human Rights.
5. Gain knowledge on roles and functioning of Election Commission

Unit I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Learning outcomes: After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

Unit II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

Learning outcomes: After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

Unit III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

Learning outcomes: After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariat

Unit IV

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level, Role of Elected and Appointed officials - Importance of grass root democracy Learning outcomes:-After completion of this unit

- student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zillapanchayat block level organisation

Unit V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Learning outcomes: After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissiononerate

References:

1) Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt.Ltd.
2) SubashKashyap, Indian Constitution, National Book Trust
3) J.A. Siwach, Dynamics of Indian Government & Politics
4) D.C. Gupta, Indian Government and Politics
5) H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal LawPublication)
6) J.C. Johari, Indian Government andPolitics Hans
7) J. Raj IndianGovernment and Politics
8) M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law,Prentice – Hall of India Pvt. Ltd.. New Delhi
9) Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

e-Resources:

1) nptel.ac.in/courses/109104074/8
2) nptel.ac.in/courses/109104045/
3) nptel.ac.in/courses/101104065/
4) www.hss.iitb.ac.in/en/lecture-details
   www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution
5) https://www.javatpoint.com/html-tutorial
6) https://www.javatpoint.com/css-tutorial

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
20SH4T03	NUMERICAL METHODS & TRANSFORMATIONS	3	0	0	3

Course Objectives:

- To familiarize the techniques in partial differential equations
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced levelby handling various real world applications.

Course Outcomes:

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

CO1: Evaluate approximating the roots of polynomial and transcendental equations

CO2: Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals.

CO3: Apply different algorithms for approximating the solutions of ordinary Differential equations toits analytical computations .

CO4: Apply the Laplace transform for solving differential equations.

CO5: Find or compute the Fourier series of periodic signals and apply integral Expressions for the forwards and inverse Fourier transform to a range of non- periodic waveforms.

UNIT I : Iterative methods:

Introduction – Bisection method – Iteration method – Newton-Raphson method (One variable) – Jacobi and Gauss-Seidel methods for solving system of equations.

UNIT II: Interpolation:

Introduction – Finite differences – Forward differences – Backward differences – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula.

UNIT III: Numerical integration and solution of ordinary differential equations

Trapezoidal rule – Simpson's 1/3rd and 3/8th rule – Solution of ordinary differential equations by Taylor's series – Picard's method of successive approximations – Euler's method – Runge-Kutta method (second and fourth order).

UNIT-IV: Laplace Transform :

Laplace transforms of standard functions-Shifting Theorems, Transforms of derivatives and integrals , Inverse Laplace transforms– Convolution theorem (with out proof).Application : Solutions of ordinary differential equations using Laplace transforms

UNIT V: Fourier Series:

Introduction- Periodic functions – Fourier series of -periodic function - Dirichlet's conditions– Even and odd functions –Change of interval– Half-range sine and cosine series. **Fourier Transforms**: Fourier integral theorem (without proof) – Fourier sine and cosine integrals - sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, Wiley-India.
2. Dass H.K., Rajnish Verma. Er., Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
20IT4T01	OBJECT ORIENTED PROGRAMMING THROUGH JAVA	3	0	0	3

Course Objectives:

The learning objectives of this course are:

- To identify Java language components and how they work together in applications
- To learn the fundamentals of object-oriented programming in Java, including defining classes,invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exceptionhandling in Java applications
- To understand how to design applications with threads in Java
- To understand how to use Java APIs for program development

Course Outcomes:

At the end of the Course, the student will be able to

CO1: Able to realize the concept of Object Oriented Programming & Java Programming Constructs

CO2: Able to describe the basic concepts of Java such as operators, classes, objects, inheritance, packages,Enumeration and various keywords.

CO3: Apply the concept of exception handling and Input/ Output operations

CO4: Able to design the applications of Java & Java applet

CO5: Able to Analyse & Design the concept of Event Handling and Abstract Window Toolkit

UNIT I

Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java. time. Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling :Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause.

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Methods for Comparison of Strings, Methods for Modifying Strings, Methods for Searching Strings, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface, Creating JDBC Application, JDBC Batch Processing, JDBC Transaction Management

Text Books:

1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2) The complete Reference Java, 8th edition, Herbert Schildt, TMH

References Books:

1) Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
2) Murach's Java Programming, Joel Murach

E-Resources:

1) https://nptel.ac.in/courses/106/105/106105191/
2) https://www.w3schools.com/java/java_data_types.asp

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
20CD4T01	DATA WAREHOUSING AND MINING	3	0	0	3

Course Objectives:

- To understand and implement classical models and algorithms in data warehousing and data mining.
- To analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
- To assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior.

Course Outcomes:

At the end of the Course, the student will be able to

CO1 : Summarize the architecture of data warehouse
CO2 : Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data.
CO3 : Construct a decision tree and resolve the problem of model over fitting
CO4 : Compare Apriori and FP-growth association rule mining algorithms for frequent item set generation
CO5 : Apply suitable clustering algorithm for the given data set

UNIT- I

Data Warehouse and OLAP Technology: An Overview: What Is a Data Warehouse? A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining. (Han &Kamber).

UNIT- II

Data Mining: Introduction, What is Data Mining?, Motivating challenges, The origins of Data Mining, Data Mining Tasks, Types of Data, Data Quality.
Data Pre-processing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity. (Tan &Vipin).

UNIT -III

Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction.
Model Over fitting: Due to presence of noise, due to lack of representation samples, evaluating the performance of classifier: holdout method, random sub sampling, cross-validation, bootstrap. Bayes Theorem, Naïve Bayes Classifier (Tan &Vipin)

UNIT -IV

Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Item Set Generation, A priori Principle, A priori Algorithm, Rule Generation, Compact Representation of Frequent Item sets, FP- Growth Algorithm. (Tan & Vipin)

UNIT -V

Cluster Analysis: Basic Concepts and Algorithms: Overview, What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan &Vipin).

Text Books :

1. Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression,Pearson, 2015.
2. Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011

Reference Books:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010
2. Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
3. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008
4. Data Mining Techniques, Arun K Pujari, Universities Press, 2001

Web Resources:

NPTEL Online Course on Data Mining : https://onlinecourses.nptel.ac.in/noc18_cs14/preview

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
20CS4T02	FORMAL LANGUAGES AND AUTOMATA THEORY	3	0	0	3

Course Objectives:

- To learn fundamentals of Regular and Context Free Grammars and Languages
- To understand the relation between Regular Language and Finite Automata and machines
- To learn how to design Automata's and machines as Acceptors, Verifiers and Translators
- To understand the relation between Contexts free Languages, PDA and TM
- To learn how to design PDA as acceptor and TM as Calculators

Course Outcomes:

At the end of the Course, the student will be able to

CO1: Classify machines by their power to recognize languages.
CO2: Summarize language classes & grammars relationship among them with the help of Chomskyhierarchy
CO3: Employ finite state machines to solve problems in computing
CO4: Illustrate deterministic and non-deterministic machines
CO5: Quote the hierarchy of problems arising in the computer science

UNIT I

Finite Automata: Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with Є-Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata.

UNIT II

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion.

UNIT III

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, Є-Productions and Unit Productions, Normal Forms-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

UNIT IV

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

UNIT V

Turning Machine: Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Un-decidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Modified PCP, Classes of P and NP, NP-Hard and NP-Complete Problems.

Text Books:

1) Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008
2) Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishra and N. Chandrasekharan, 3rd Edition, PHI, 2007

Reference Books:

1) Elements of Theory of Computation, Lewis H.P. &Papadimition C.H., Pearson /PHI
2) Theory of Computation, V. Kulkarni, Oxford University Press, 2013
3) Theory of Automata, Languages and Computation, Rajendra Kumar, McGraw Hill, 2014

e-Resources:

1) https://nptel.ac.in/courses/106/104/106104028/

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
20SH4T01	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	3	0	0	3

Course Objectives:

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals

Course Outcomes:

CO1: The Learner is equipped with the knowledge of estimating the Demand and demand elasticity's for aproduct.

CO2: The knowledge of understanding of the Input-Output-Cost relationships and estimation of the leastcost combination of inputs.

CO3: The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.

CO4: The Learner is able to prepare Financial Statements and the usage of various Accounting tools forAnalysis.

CO5: The Learner can able to evaluate various investment project proposals with the help of capitalbudgeting techniques for decision making.

UNIT I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

UNIT II

Theories of Production and Cost Analyses: Theories of Production function- Law of Variable proportions- Isoquants and Iso costs and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

UNIT III

Introduction to Markets, Theories of the Firm & Pricing Policies: : Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features– Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features –Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State / Public Enterprises and their forms.

UNIT IV

Introduction to Accounting & Financing Analysis: Introduction to Accounting & Financing Analysis: Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements - Analysis and Interpretation of Financial Statements - Ratio Analysis.

UNIT V

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (Pay-Back Period, Accounting Rate of Return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Text Books:

1) A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

Reference Books:

1) Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd.
2) JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition
3) N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd.
4) MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
5) I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
6) V. Maheswari, Managerial Economics, S. Chand & Company Ltd.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
20IT4L01	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB	0	0	3	1.5

Course Objectives:

The aim of this lab is to

- Practice programming in the Java
- Gain knowledge of object-oriented paradigm in the Java programming language
- Learn use of Java in a variety of technologies and on different platforms

Course Outcomes:

At the end of the Course, the student will be able to

CO1: Evaluate default value of all primitive data type, Operations, Expressions, Control-flow, Strings

CO2: Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism.

CO3: Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism

CO4: Construct Threads, Event Handling, implement packages, developing applets

Exercise - 1 (Basics)

a) Write a JAVA program to display default value of all primitive data type of JAVA

b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers

Exercise - 2 (Operations, Expressions, Control-flow, Strings)

a) Write a JAVA program to search for an element in a given list of elements using binary searchmechanism.

b) Write a JAVA program to sort for an element in a given list of elements using bubble sort

c) Write a JAVA program to sort for an element in a given list of elements using merge sort.

d) Write a JAVA program using String Buffer to delete, remove character

Exercise - 3 (Class, Objects)

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.

b) Write a JAVA program to implement constructor

Exercise - 4 (Methods)

a) Write a JAVA program to implement constructor overloading.

b) Write a JAVA program implement method overloading

Exercise - 5 (Inheritance)

a) Write a JAVA program to implement Single Inheritance
b) Write a JAVA program to implement multi level Inheritance
c) Write a java program for abstract class to find areas of different shapes

Exercise - 6 (Inheritance - Continued)

a) Write a JAVA program give example for "super" keyword.
b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?

Exercise - 7 (Exception)

a) Write a JAVA program that describes exception handling mechanism
b) Write a JAVA program Illustrating Multiple catch clauses

Exercise – 8 (Runtime Polymorphism)

a) Write a JAVA program that implements Runtime polymorphism
b) Write a Case study on run time polymorphism, inheritance that implements in above problem

Exercise – 9 (User defined Exception)

a) Write a JAVA program for creation of Illustrating throw
b) Write a JAVA program for creation of Illustrating finally
c) Write a JAVA program for creation of Java Built-in Exceptions
d) Write a JAVA program for creation of User Defined Exception

Exercise – 10 (Threads)

a) Write a JAVA program that creates threads by extending Thread class .First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds ,(Repeat the same by implementing Runnable)
b) Write a program illustrating **isAlive** and **join ()**
c) Write a Program illustrating Daemon Threads.

Exercise - 11 (Threads continuity)

a) Write a JAVA program Producer Consumer Problem
b) Write a case study on thread Synchronization after solving the above producer consumer problem

Exercise – 12 (Packages)

a) Write a JAVA program illustrate class path
b) Write a case study on including in class path in your os environment of your package.
c) Write a JAVA program that import and use the defined your package in the previous Problem

Exercise - 13 (Applet)

a) Write a JAVA program to paint like paint brush in applet.
b) Write a JAVA program to display analog clock using Applet.
c) Write a JAVA program to create different shapes and fill colors using Applet.

Exercise - 14 (Event Handling)

a) Write a JAVA program that display the x and y position of the cursor movement using Mouse.
b) Write a JAVA program that identifies key-up key-down event user entering text in a Applet

TEXT BOOKS:

1. Herbert schildt and Dale skrien, Java Fundamentals- A Comprehensive introduction, TMH.
2. P.J.Dietel and H.M.Dietel, Java: How to Program , PHI.

REFERENCE BOOKS:

1. P.Radha Krishna, Object Oriented Programming through java, Universities Press.
2. Bruce Eckel, Thinking in Java, Pearson Education.
3. S.Malhotra and S.Choudhary, Programming in Java, Oxford University Press

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
20CD4L01	DATA MINING USING PYTHON LAB	0	0	3	1.5

Course Outcomes:

At the end of the Course, the student will be able to

CO1: Apply pre-processing techniques on real world datasets

CO2: Apply a priori algorithm to generate frequent item sets.

CO3: Apply Classification and clustering algorithms on different datasets.

Note: Use python library scikit-learn wherever necessary

1. Demonstrate the following data preprocessing tasks using python libraries.
   a) Loading the dataset
   b) Identifying the dependent and independent variables
   c) Dealing with missing data

2. Demonstrate the following data pre processing tasks using python libraries.
   a) Dealing with categorical data
   b) Scaling the features
   c) Splitting dataset into Training and Testing Sets

3. Demonstrate the following Similarity and Dissimilarity Measures using python
   a) Pearson's Correlation
   b) Cosine Similarity
   c) Jaccard Similarity
   d) Euclidean Distance
   e) Manhattan Distance

4. Build a model using linear regression algorithm on any dataset.

5. Build a classification model using Decision Tree algorithm on iris dataset

6. Apply Naïve Bayes Classification algorithm on any dataset

7. Generate frequent itemsets using Apriori Algorithm in python and also generate association rules forany market basket data

8. Apply K- Means clustering algorithm on any dataset.

9. Apply Hierarchical Clustering algorithm on any dataset.

10. Apply DBSCAN clustering algorithm on any dataset.

Web Resources:

1. https://analyticsindiamag.com/data-pre-processing-in-python/
2. https://towardsdatascience.com/decision-tree-in-python-b433ae57fb93
3. https://towardsdatascience.com/calculate-similarity-the-most-relevant-metrics-in-a-nutshell-9a43564f533e
4. https://www.springboard.com/blog/data-mining-python-tutorial/
5. https://medium.com/analytics-vidhya/association-analysis-in-python-2b955d0180c
6. https://www.datacamp.com/community/tutorials/naive-bayes-scikit-learn
7. https://www.analyticsvidhya.com/blog/2019/05/beginners-guide-hierarchical-clustering/
8. https://towardsdatascience.com/dbscan-algorithm-complete-guide-and-application-with-python-scikit-learn- d690cbae4c5d

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
20CS4L03	R PROGRAMMING LAB	0	0	3	1.5

Course Objective:

In this course student will learn about the fundamentals of R programming, standard R libraries, solid understanding of R functions, write programs using the R and gain skills in R programming Language, get acquaintances with Arrays, Files, Strings, Packages, and distributions using R.

Course Outcomes:

At the end of the Course, the student will be able to

CO1: Implement basic concepts of R programming, and its different module that includes conditional,looping, lists, Strings, Functions, Frames, Arrays, and File programming.
CO2: Implement the concepts of R Script to extract the data from data frames and file operations.
CO3: Implement the various statistical techniques using R.
CO4: Extend the functionality of R by using add-on packages
CO5: Use R Graphics and Tables to visualize results of various statistical operations on data

List of Lab Experiments:

Week 1:

a) Installing R and RStudio
b) Basic functionality of R, variable, data types in R

Week 2:

a) Implement R script to show the usage of various operators available in R language.
b) Implement R script to read person's age from keyboard and display whether he is eligible for voting or not.
c) Implement R script to find biggest number between two numbers.
d) Implement R script to check the given year is leap year ornot

Week 3:

a) Implement R Script to create a list.
b) Implement R Script to access elements in the list.
c) Implement R Script to merge two or more lists. Implement R Script to perform matrix operation

Week 4:

Implement R script to perform following operations:

a) various operations on vectors
b) Finding the sum and average of given numbers using arrays.
c) To display elements of list in reverse order.
d) Finding the minimum and maximum elements in the array.

Week 9*:*

a) Implement R Script to perform Normal, Binomial distributions.
b) Implement R Script to perform correlation, Linear and multiple regression.

Week 10:

a) Introduction to Non-Tabular Data Types: Time series, spatial data, Network data. Data Transformations: Converting Numeric Variables into Factors, Date Operations, String Parsing, Geocoding

Week 5:

a) Implement R Script to perform various operations on matrices
b) Implement R Script to extract the data from dataframes.
c) Write R script to display file contents.
d) Write R script to copy file contents from one file to another

Week 6 :

a) Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcar s& cars datasets.
b) Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset

Week 7:

a) Reading different types of data sets (.txt, .csv) from Web or disk and writing in file in specific disklocation.
b) Reading Excel data sheet in R.
c) Reading XML dataset in R

Week 8:

a) Implement R Script to create a Pie chart, Bar Chart, scatter plot and Histogram (Introduction toggplot2 graphics)
b) Implement R Script to perform mean, median, mode, range, summary, variance, standard deviation operations.

Week 11:

a) Introduction Dirty data problems: Missing values, data manipulation, duplicates, forms of data dates,outliers, spelling

Week 12:

a) Data sources: SQLite examples for relational databases, Loading SPSS and SAS files, Reading fromGoogle Spreadsheets, API and web scraping examples

References:

1. R Cookbook Paperback – 2011 by Teetor Paul O Reilly Publications
2. Beginning R: The Statistical Programming Language by Dr. Mark Gardener, Wiley Publications
3. R Programming For Dummies by JorisMeysAndrie de Vries, Wiley Publications
4. Hands-On Programming with R by Grolemund, O Reilly Publications
5. Statistical Programming in R by KG Srinivas G.M. Siddesh, ChetanShetty&Sowmya B.J. - 2017edition
6. R Fundamentals and Programming Techniques, ThomasLumely.
7. R for Everyone Advanced Analytics and Graphics, Jared P. Lander- Addison WesleySeries
8. The Art of R Programming, Norman Matloff, CengageLearning
9. Maria DoloresUgarte,AnaF.Militino,AlanT.Arnholt—ProbabilityandStatisticswithR||2nd Edition on, CRC Press,2016.
10. R-programming for Data science, RogerD.Peng.
11. An Introduction to statistical learning-with applications in R, Trevor Hastie and Rob Tibshirani

E-Resources:

1. URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf (Online Resources)
2. http://nptel.ac.in/courses/106104135/48
3. http://nptel.ac.in/courses/110106064/

SOFTWARE requirements:

1. The R statistical software program. Available from: https://www.r-project.org/
2. RStudio an Integrated Development Environment (IDE) for R. Available from: https://www.rstudio.com/

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
20CD4S01	MONGO DB	1	0	2	2

Course Outcomes:

At the end of the Course, the student will be able to

CO1 :Installing and configuring mongoDB in windows

CO2 : Perform all database operations using mongoDB

CO3: Develop applications by integrating mongoDB with java/PHP.

List of Experiments:

1. MongoDB installation and configuration in windows.
2. Demonstrate how to create and drop a database in MongoDB.
3. Creating the Collection in MongoDB on the fly
4. Creating collection with options before inserting the documents and drop the collection created.
5. MongoDB insert document
   a) Insert single document
   b) Insert multiple documents in collection
6. Querying all the documents in json format and Querying based on the criteria.
7. MongoDB update document
   a) Using update() method.
   b) Using save() method.
8. MongoDB delete document from a collection.
   a) Using remove() method.
   b) Remove only one document matching your criteria
   c) Remove all documents
9. MongoDB Projection
10. limit() ,skip(), sort() methods in MongoDB
11. MongoDB indexing
    a) Create index in MongoDB
    b) Finding the indexes in a collection
    c) Drop indexes in a collection
    d) Drop all the indexes
12. MongoDB with java and PHP
    a) Create a simple application that uses MongoDB with Java
    b) Create a simple application that uses MongoDB with PHP

Web References:

1. https://beginnersbook.com/2017/09/mongodb-tutorial/

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - V

Course Code	Course Name	L	T	P	C
20IT5T01	DESIGN AND ANALYSIS OF ALGORITHMS	3	0	0	3

Course Objectives:

1. To provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms
2. To introduce the different algorithmic approaches for problem solving through numerous example problems
3. To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

Course Outcomes:

At the end of the Course, the student will be able to

1. Describe asymptotic notation used for denoting performance of algorithms
2. Analyze the performance of a given algorithm and denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms
3. List and describe various algorithmic approaches
4. Solve problems using divide and conquer, greedy, dynamic programming, backtracking and branch and bound algorithmic approaches
5. Apply graph search algorithms to real world problems
6. Demonstrate an understanding of NP- Completeness theory and lower bound theory.

UNIT I

Introduction: Algorithm Definition, Algorithm Specification, performance Analysis, Pseudo code for expressing the algorithm, asymptotic notation.
Sets & Disjoint set union: introduction, union and find operations.
Basic Traversal & Search Techniques: Techniques for Graphs, connected components and Spanning Trees, Bi-connected components and DFS.

UNIT II

Divide and Conquer: General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort.
The Greedy Method: The general Method, container loading, knapsack problem, Job sequencing with deadlines, minimum-cost spanning Trees.

UNIT III

Dynamic Programming: The general method, multistage graphs, All pairs-shortest paths, single- source shortest paths: general weights, optimal Binary search trees, 0/1 knapsack, reliability Design, The traveling salesperson problem.

UNIT IV

Backtracking: The General Method, The 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles.
Branch and Bound: FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1 Knapsack problem, Traveling salesperson problem.

UNIT V

P,NP, NP-Hard and NP-Complete problems: Basic concepts, Cook's Theorem.

String Matching: Introduction, String Matching-Meaning and Application, NaÏve String Matching Algorithm, Rabin-Karp Algorithm, Knuth-Morris-Pratt Automata.

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.
2. Harsh Bhasin, " Algorithms Design & Analysis", Oxford University Press.

Reference Books:

1. Horowitz E. Sahani S: "Fundamentals of Computer Algorithms", 2nd Edition, Golgotha Publications, 2008.
2. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press

e-Resources:

1)http://nptel.ac.in/courses/106101060/

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - V

Course Code	Course Name	L	T	P	C
20CI5T02	MACHINE LEARNING	3	0	0	3

COURSE OBJECTIVES:

1. Acquire theoretical Knowledge on setting hypothesis for pattern recognition.
2. Apply suitable machine learning techniques for data handling and to gain knowledge from it.
3. Evaluate the performance of algorithms and to provide solution for various real world applications.

COURSE OUTCOMES:

At the end of the Course, the student will be able to

1. Recognize the characteristics of Machine Learning techniques that enable to solve real world problems
2. Recognize the characteristics of machine learning strategies
3. Apply various supervised learning methods to appropriate problems
4. Identify and integrate more than one techniques to enhance the performance of learning
5. Create probabilistic and unsupervised learning models for handling unknown pattern
6. Analyze the co-occurrence of data to find interesting frequent patterns

UNIT I

Introduction to Machine Learning

Introduction ,Components of Learning , Learning Models , Geometric Models, Probabilistic Models, Logic Models, Grouping and Grading, Designing a Learning System, Types of Learning, Supervised, Unsupervised, Reinforcement, Perspectives and Issues, Version Spaces, PAC Learning, VC Dimension.

UNIT II

Supervised and Unsupervised Learning

Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Neural Networks: Introduction, Perception, Multilayer Perception, Support Vector Machines: Linear and Non-Linear, Kernel Functions, K Nearest Neighbours.

Introduction to clustering, K-means clustering, K-Mode Clustering

UNIT III

Ensemble and Probabilistic Learning

Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking.

Gaussian mixture models - The Expectation-Maximization (EM) Algorithm, Information Criteria, Nearest neighbour methods - Nearest Neighbour Smoothing, Efficient Distance Computations: the KD-Tree, Distance Measures.

UNIT IV

Reinforcement Learning and Evaluating Hypotheses

Introduction, Learning Task, Q Learning, Non deterministic Rewards and actions, temporal-difference learning, Relationship to Dynamic Programming, Active reinforcement learning, Generalization in reinforcement learning.

Motivation, Basics of Sampling Theory: Error Estimation and Estimating Binomial Proportions, The Binomial Distribution, Estimators, Bias, and Variance.

UNIT V

Genetic Algorithms: Motivation, Genetic Algorithms: Representing Hypotheses, Genetic Operator, Fitness Function and Selection, An Illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning: Lamarkian Evolution, Baldwin Effect, Parallelizing Genetic Algorithms.

TEXT BOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 3rd Edition2014.
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar " Foundations of Machine Learning", MIT Press,2012.
3. Tom Mitchell, "Machine Learning", McGraw Hill, 3rdEdition, 1997.
4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015.

REFERENCE BOOKS:

1. CharuC.Aggarwal,"DataClassificationAlgorithmsandApplications",CRCPress,2014.
2. Charu C. Aggarwal, "DATA CLUSTERING Algorithms and Applications", CRC Press,
3. 2014.
4. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012
5. Jiawei Han and Micheline Kambers and JianPei, "Data Mining Concepts andTechniques",3rd edition, Morgan Kaufman Publications, 2012.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - V

Course Code	Course Name	L	T	P	C
20IT5T02	OPERATING SYSTEM	3	0	0	3

COURSE OBJECTIVES:

1. Understand main concepts of OS and to analyze the different CPU scheduling policies.
2. Understand process synchronization and deadlock management.
3. Understand memory management and virtual memory techniques.
4. Appreciate the concepts of storage and file management.
5. Study OS protection and security concepts

Course Outcomes:

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

1. Explain different functions and types of operating system and implement various process management concepts for maximization of CPU throughput
2. Analyse synchronization problems and design a deadlock management scheme.
3. Optimize memory management for improved system performance.
4. Demonstrate disk management, implement disk scheduling and file system interface
5. Describe and frame protection and security policy for OS.

UNIT I

Operating System Overview: Objectives and functions, Computer System Architecture, Evolution of Operating Systems, System Services, System Calls, System Programs, OS Structure, Virtual machines.

Process Management: Process concepts, CPU scheduling-criteria, algorithms with evaluation, Preemptive / Non-Preemptive Scheduling, Threads, Multithreading Models.

UNIT II

Concurrency: Process synchronization, the critical- section problem, Peterson's Solution, synchronization Hardware, semaphores, classic problems of synchronization, monitors.

Deadlocks: Principles of deadlock–system model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock

UNIT III

Memory Management: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation.

Virtual Memory: Demand paging, page replacement algorithms, Allocation of Frames, Thrashing.

UNIT IV

Mass-storage structure: Overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.
File System implementation: Access Methods, File system structure, file system implementation, directory implementation, allocation methods, free-space management.

UNIT V

Protection: Goals and Principles of Protection, Implementation of Access Matrix, Accesscontrol, Revocation of Access Rights.
Security: The Security problem, program threats, system and network threats, implementingsecurity defences

TEXT BOOKS:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin,Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings,Prentice Hall of India.
3. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing

REFERENCE BOOKS:

1. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
2. Modern Operating Systems, Andrew S Tanenbaum 3rd Edition PHI.
3. Operating Systems, R. Elmasri, A. G. Carrick and D. Levine, Mc Graw Hill.
4. Operating Systems in depth, T. W. Doeppner, Wiley

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - V

Course Code	Course Name	L	T	P	C
20CD5E11	SOFTWARE ENGINEERING Professional Elective – 1	3	0	0	3

Course Outcomes:
At the end of the Course the Student will be able to:
CO1: Explain about appropriate software process models for software project/product.
CO2: Interpret the functional, non–functional requirements and requirement Engineering Process.
CO3: Choose the Architecture for a given software application.
CO4: Identify appropriate test strategies that can be applied to a given software application.
CO5: Analyze various Risk Management and Quality Management Techniques.

UNIT-I
INTRODUCTION TO SOFTWARE ENGINEERING: Software, The Nature of Software, Software Myths, The Software Process, A Generic Process Model, CMMI.
PROCESS MODELS: Prescriptive Process Models- The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models. Specialized Process Models. The Unified Process.

UNIT-II
SOFTWARE REQUIREMENTS: Introduction of Requirement, User Requirements, System requirements, Functional and Non-functional Requirements, The Requirement Engineering Process, **Requirements Elicitation**: Fact finding Techniques, Data/system Analyst, **Requirement Analysis**: Structured Analysis, Data oriented Analysis, Object oriented Analysis, Prototype. **Requirement Specification**: SRS, Characteristics and Components of SRS, Requirements Validation, Requirements Management.

UNIT-III
DESIGN ENGINEERING: The Design Process, Design Concepts, the Design Model. **ARCHITECTURAL DESIGN**: Software Architecture, Architectural Styles, Architectural Design, Architectural Mapping using Data Flow.

UNIT-IV
SOFTWARE TESTING STRATEGIES:
A Strategic Approach to Software Testing, Test Strategies for Conventional Software and Object Oriented Software, Validation Testing, White- Box Testing, Basis Path Testing, Black-Box Testing, System Testing.

UNIT-V
RISK MANAGEMENT:
Reactive versus Proactive Risk Strategies, Risk Identification, Risk Projection, Risk Refinement, RMMM, RMMM Plan.
QUALITY MANAGEMENT:
Software Quality, Informal Reviews, Formal Technical Reviews, Statistical Software Quality Assurance, Software Reliability.

TEXTBOOKS:

1. Roger S.Pressman, *Software Engineering a Practitioner's Approach*, 7thEdition, TMH,2010.
2. Sommerville, *Software Engineering*, 9th Edition, Pearson Education, 2011.

REFERENCES:

1. K.K.Agarwal & Yogesh Singh, *Software Engineering*, 3rdEdition, New Age International Publishers, 2008.
2. PankajJalote, *An Integrated Approach to Software Engineering*, 3rd Edition, Narosa PublishingHouse,2011.

E- REFERENCES:

1. https://nptel.ac.in/Courses/SoftwareEngineering
2. https://www.Coursera.org/Courses?query=software engineering
3. https://www.udemy.com/Courses/development/software-engineering

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - V

Course Code	Course Name	L	T	P	C
20CD5E12	OBJECT ORIENTED ANALYSIS AND DESIGN Professional Elective – 1	3	0	0	3

Course Objectives:

1. To understand how to solve complex problems
2. Analyse and design solutions to problems using object oriented approach
3. Study the notations of Unified Modelling Language

Course Outcomes:

1. Ability to find solutions to the complex problems using object oriented approach
2. Represent classes, responsibilities and states using UML notation
3. Identify classes and responsibilities of the problem domain
4. Evaluate the behaviour system.
5. Build solutions to the complex problems using OOAD and UML notations

UNIT I

Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems, Evolution of Object Model, Foundation of Object Model, Elements of Object Model, Applying the Object Model.

UNIT II

Classes and Objects: Nature of object, Relationships among objects, Nature of a Class, Relationship among Classes, Interplay of Classes and Objects, Identifying Classes and Objects, Importance of Proper Classification, Identifying Classes and Objects, Key abstractions and Mechanisms.

UNIT III

Introduction to UML: Why we model, Conceptual model of UML, Architecture, Classes, Relationships, Common Mechanisms, Class diagrams, Object diagrams

UNIT IV

Basic Behavioral Modeling: Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams.

UNIT V

Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams

Text Books:

1. "Object- Oriented Analysis And Design with Applications", Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, 3rd edition, 2013, PEARSON.
2. "The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh, Ivar Jacobson, 12th Impression, 2012, PEARSON

Reference Books:

1. "Object-oriented analysis and design using UML", Mahesh P. Matha, PHI
2. "Head first object-oriented analysis and design", Brett D. McLaughlin, Gary Pollice, Dave West, O"Reilly
3. "Object-oriented analysis and design with the Unified process", John W. Satzinger, Robert B. Jackson, Stephen D. Burd, Cengage Learning
4. The Unified modeling language Reference manual", James Rumbaugh, Ivar Jacobson, Grady Booch, Addison-Wesley

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - V

Course Code	Course Name	L	T	P	C
20CD5E13	PRINCIPLES OF PROGRAMMING LANGUAGES Professional Elective – 1	3	0	0	3

Course Objectives:

1. To understand and describe syntax and semantics of programming languages.
2. To understand data, data types, and basic statements.
3. To understand call-return architecture and ways of implementing them.
4. To understand object-orientation, concurrency, and event handling in programming
5. Languages.
6. To develop programs in non-procedural programming paradigms

Course Outcomes:

1. Describe syntax and semantics of programming languages.
2. Explain data, data types, and basic statements of programming languages.
3. Design and implement subprogram constructs, Apply object - oriented, concurrency, and event.
4. Handling programming constructs. Develop programs in Scheme, ML, and Prolog.
5. Understand and adopt new programming languages

UNIT I

Syntax and Semantics: Evolution of Programming Languages, Describing Syntax, Context, Free Grammars, Attribute Grammars, Describing Semantics, Lexical Analysis, Parsing, Recursive - Decent Bottom - Up Parsing.

UNIT II

Data, Data Types, and Basic Statements: Names, Variables, Binding, Type Checking, Scope, Scope Rules, Lifetime and Garbage Collection, Primitive Data Types, Strings, Array Types, Associative Arrays, Record Types, Union Types, Pointers and References, Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Assignment Statements, Mixed Mode Assignments, Control Structures – Selection, Iterations, Branching, Guarded Statements.

UNIT III

Sub Programs and Implementations: Subprograms, Design Issues, Local Referencing, Parameter Passing, Overloaded Methods, Generic Methods, Design Issues for Functions, Semantics of Call and Return, Implementing Simple Subprograms, Stack and Dynamic Local Variables, Nested Subprograms, Blocks, Dynamic Scoping.

UNIT IV

Object- Orientation, Concurrency, and Event Handling: Object – Orientation, Design Issues for OOP Languages, Implementation of Object, Oriented Constructs, Concurrency, Semaphores, Monitors, Message Passing, Threads, Statement Level Concurrency, Exception Handling, Event Handling.

UNIT V

Functional Programming Languages: Introduction to Lambda Calculus, Fundamentals of Functional Programming Languages, Programming with Scheme, – Programming with ML.

Logic Programming Languages: Introduction to Logic and Logic Programming, Programming with Prolog, Multi - Paradigm Languages.

Text Books:

1. Robert W. Sebesta, "Concepts of Programming Languages", Tenth Edition, Addison Wesley,2012.
2. Programming Langugaes, Principles & Paradigms, 2ed, Allen B Tucker, RobertENoonan,TMH.

References:

1. R. Kent Dybvig, "The Scheme programming language", Fourth Edition,MIT Press,2009.
2. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Prentice Hall,1998.Richard A. O'Keefe, "The craft of Prolog", MITPress,2009.
3. W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition.

E-Resources:

https://nptel.ac.in/courses/106102067

DEPARTMENT OF CSE - DATA SCIENCE

SEMESTER - V

Course Code	Course Name	L	T	P	C
20CD5E13	INTERNET OF THINGS Professional Elective – 1	3	0	0	3

Course Objectives:

1. Understand the basic characteristics of IoT system
2. Realize the different IoT Protocols and architectures
3. Analyze the cloud interface and security concerns of IoT devices
4. Introduce programming in various real-time hardware platforms
5. Design a complete IoT ecosystem for various smart applications

Course Outcomes:

1. Ability to learn characteristics, applications, components and challenges of Internet of Things (IOT)
2. Create understanding of IOT networking concepts – terminologies, stack components , infrastructure and data protocols
3. Create understanding of the concept of Cloud based IOT technologies, cloud service providers and security aspects
4. Develop skills in understanding and programming the Arduino and Raspberry Pi hardware platforms
5. Make the student understand the requirements, components ,challenges and develop various application areas - smart homes, smart grids, smart health care, smart cities and industrial IOT

UNIT I

Introduction to IOT: Characteristics of IOT, Applications of IOT, IOT Categories, IOT Enablers and Connectivity Layers, Sensors, Actuators, IOT Components & Implementation, Challenges for IOT

UNIT II

IOT Networking & Connectivity Technologies: Connectivity terminologies-IOT Node, LAN,WAN, Gateway, IOT protocol Stack vs. Web Stack, IOT Identification and Data Protocols-IPV4,IPV6,HTTP,MQTT,COAP,AMQP,DDS Connectivity Technologies – Zigbee, Bluetooth, LoRa
.

UNIT III

Cloud for IOT: IOT with Cloud-Challenges, Cloud service providers for IOT-Overview, Cloud service model, Cloud Computing – Security aspects, Case Study, Fog computing, Edge computing

UNIT IV

Hardware Platforms: Programming with Arduino-Features of Arduino, Components of Arduino Board, Arduino IDE, Program Elements, Raspberry Pi – Introduction, Architecture, PIN Configuration, Implementation of IOT with Raspberry Pi

UNIT V

IOT Applications : Smart Homes-Smart Home Origin, Technologies, Implementation, Smart Grids-Characteristics, Benefits, Architecture, Components, Smart Cities-Characteristics, Frameworks, Challenges, Industrial IOT-Requirements, Design Considerations, Applications

Text Books:

1. Internet of Things, Jeeva Jose, Khanna Publishing, 2018
2. Internet of Things, Abhishek S Nagarajan, RMD Sundaram, Shriram K Vasudevan, Wiley, 2019

Reference Books:

1. The Internet of Things, Michael Miller, Pearson Education Limited, 2015
2. IoT Applications, Security Threats, and Countermeasures, Padmalaya Nayak, Niranjan Ray, P. Ravichandran, Taylor &Francis,2021
3. Internet of Things: Architecture, Implementation and Security, MayurRamgir, Pearson Education Limited, 2019
4. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan Trollope, David Hanes, Patrick Gassetete, Jerome Henry,Pearson Education Limted, 2017.
5. Beginning LoRa Radio Networks with Arduino, Pradeeka Seneviratne, Apress, 2019

SEMESTER - V

Course Code	Course Name	L	T	P	C
20GE5M03	Intellectual Property Rights and Patents (IPR & PATENTS)	2	0	0	0

Course Objectives:

1. Understand the basic characteristics of IoT system
2. Realize the different IoT Protocols and architectures
3. Analyze the cloud interface and security concerns of IoT devices
4. Introduce programming in various real-time hardware platforms
5. Design a complete IoT ecosystem for various smart applications

Course Outcomes:

1. Ability to learn characteristics, applications, components and challenges of Internet of Things (IOT)
2. Create understanding of IOT networking concepts – terminologies, stack components , infrastructure and data protocols
3. Create understanding of the concept of Cloud based IOT technologies, cloud service providers and security aspects
4. Develop skills in understanding and programming the Arduino and Raspberry Pi hardware platforms
5. Make the student understand the requirements, components ,challenges and develop various application areas - smart homes, smart grids, smart health care, smart cities and industrial IOT

UNIT I : Introduction to Intellectual property

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT II : Law of Copyrights

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

UNIT III : Law of Patents

Foundation of patent law, patent searching process, ownership rights and transfer. Patent litigation. Dilution of patent rights.

UNIT IV : Trade Marks

Purpose and function of trademarks, acquisition of trade mark rights, protectable matter (strength and categories of trade marks), selecting, and evaluating trade mark, trade mark registration processes.

UNIT - V: Trade Secrets:

Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secretes litigation.
Real time examples must be added to the concepts requires.

REFERENCES:

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, prabuddha ganguli, Tata Mc Graw Hill Publishing Company Ltd.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - V

Course Code	Course Name	L	T	P	C
20CD5L01	OPERATING SYSTEMS LAB	1	0	2	2

Course Outcomes:

At the end of the Course, the student will be able to

1. Evaluate the performance of different types of CPU scheduling algorithms
2. Implement producer-consumer problem, reader-writers problem and Dining philosophers' problem using semaphores.
3. Simulate Banker's algorithm for deadlock avoidance
4. Implement paging techniques and page replacement policies, memory allocation techniques in memory management.
5. Implement disk scheduling techniques and file allocation strategies .

TASK 1

Practice the following commands in UNIX environment

a) cp b) rm c) mv d) chmod e) ps f) kill

TASK 2

Write a program that makes a copy of a file using standard I/O and system calls

TASK 3

Simulate the following Scheduling algorithms.

a) FCFS b)SJF c)Priority d)Round Robin

TASK 4

Simulate the Producer Consumer problem using semaphores

TASK 5

Simulate the Readers – Writers problem using semaphores.

TASK 6

Simulate the Dining Philosophers problem using semaphores

TASK 7

Simulate Bankers Algorithm for Deadlock Avoidance.

TASK 8

Simulate First Fit and Best Fit algorithms for Memory Management.

TASK 9

Simulate paging technique of memory management.

TASK 10

Simulate page replacement Algorithms.

a)FIFO b)LRU

TASK 11

Simulate following Disk Scheduling algorithms.

a) FCFS b) SSTF c) SCAN d) C-SCAN
e) LOOK f) C-LOOK

TASK 12

Simulate file allocation strategies.

a) Sequential b) Indexed c) Linked

Text Books/ References:

1. Operating System Concepts- Abraham Silberchatz , Peter B. Galvin, Greg Gagne 7th Edition,JohnWiley.

2. Operating Systems– Internal and Design Principles Stallings, Fifth Edition–2005, Pearsoneducation/PHI.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - V

Course Code	Course Name	L	T	P	C
20CI5L02	MACHINE LEARNING AB	0	0	3	1.5

Course Outcomes:

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

1. Understand the implementation procedures for the machine learning algorithms
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms
4. Identify and apply Machine Learning algorithms to solve real world problems

TASKS :

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

Reference Books:

1. Python Machine Learning by Sebastian Raschka, Oreilly Publishers
2. Machine Learning – Tom M. Mitchell, -MGH
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VI

Course Code	Course Name	L	T	P	C
20CD6T01	COMPUTER NETWORKS	3	0	0	3

Course Objectives:

1. Learn various Network topologies and Network models and transmission media..
2. Describe error detection, Flow control mechanisms and Multiple access protocols.
3. Understand different Routing technologies involved to route packets
4. Distinguish the standard Internet Protocol (IP), Transport Control Protocol (TCP) andUser Datagram Protocol for Internet.
5. Analyse and understand application layer protocols.

Course Outcomes:

At the end of the Course, the student will be able to

1. Define basic terminologies of Computer Networks and to apply various networking configurations and transmission media to build a network for an organization.
2. Summarize error correction and detection techniques and MAC Protocols for specific networks.
3. Illustrate various routing algorithms and outline their applications.
4. Distinguish TCP and UDP protocols.
5. Make use of various application layer protocols in Internet based Applications

UNIT I

Computer Networks: Uses of Computer Networks, Network Hardware, Network Software, Types of networks, Network topologies, Layered architecture. Reference Models: OSI, TCP/IP, ARPANET, Internet, and ATM header, Reference model, QoS.

Physical Layer: Guided Transmission Media, Wireless Transmission Media, Communication Satellites. Switching and Multiplexing, Mobile Telephone Network, GSM

UNIT II

Data link layer: Design Issues, Framing, Error Detection, Elementary Data Link Protocol and Sliding Window Protocols.

Medium Access sub layer: Static vs. Dynamic, Multiple Access Protocols: ALOHA, CSMA and Collision Free Protocols. Ethernet (IEEE 802.3).

UNIT III

The Network Layer: Network Layer Design Issues, Routing Algorithms-Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast routing, multicast routing, Congestion control algorithms, Quality of Service Application Requirements, Traffic Shaping, Packet Scheduling, Internetworking, The Network Layer in the Internet-The IP version 4.0 protocol, IP Addresses, IP Version 6.0, Internet Control Protocols.

UNIT IV

The Transport Layer: The Transport Service-Services Provided to the Upper Layers, Transport Service Primitives, Elements of Transport Protocols –Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Congestion control-Desirable Bandwidth allocation, Regulating the sending rate, The Internet Transport Protocols: Introduction to UDP, Remote procedure call, Real-Time transport protocols, Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT V

The Application Layer: DNS- The Domain Name System, Electronic mail, world wide web. FTP, HTTP, TELNET.

Text Books:

1. Computer Networks - Andrew S Tanenbaum, 4th Edition, PearsonEducation/PHI
2. Data Communications and Networking-Behrouz A. Forouzan,Third EditionTMH

Reference Books:

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, PearsonEducation.
2. Understanding communications and Networks- 3rd Edition, W.A. Shay,Thomson
3. Computer Networks – Dr.G.S.Bapiraju, 2nd Edition GRIETPublications

DEPARTMENT OF CSE - DATA SCIENCE

SEMESTER - VI

Course Code	Course Name	L	T	P	C
20CD6T02	BIG DATA ANALYTICS	3	0	0	3

Pre- Requisites:
Students should have knowledge of one Programming Language (Java preferably), Practiceof SQL (queries and sub queries), exposure to Linux Environment.

Course Objectives:

1. Describe Big Data and its use cases from selected business domains.
2. Provide an overview of HDFS Architecture and its daemon services.
3. Perform Map Reduce analytics with YARN using Hadoop.
4. Understand the working of data ingestion tools and PIG Latin.
5. Use Hadoop related tools such as Hive and HBase for big data analytics.

Course Outcomes:

At the end of the Course, the student will be able to

1. Understand the concepts of Big Data and navigation of the Hadoop Ecosystem.
2. Illustrate the HDFS Architecture and the coordination service of Hadoop.
3. Implement distributed processing Map Reduce Paradigm with YARN.
4. Analyze importing and exporting data from Hadoop using Sqoop, Flume and workingwith PIG.
5. Examine the data stores - Hive and HBase on Hadoop

UNIT I

Introduction to Big Data and Hadoop:
Challenges of Traditional Decision Making, Solution with Big Data Analytics, Classification of Digital Data, Definition of Big Data, Characteristics of Big Data, Definition of Big Data Analytics, Features of Hadoop, History of Hadoop, RDBMS Vs. Hadoop, Hadoop Distributors, Ecosystems of Hadoop.

UNIT II

HDFS and Zoo Keeper:
HDFS: Concepts – Blocks, HDFS Components, Block Caching, Characteristics of HDFS, HDFS High Availability Architecture and its types, HDFS Command Line, Data Flow – Anatomy of File read and File write operations.
Zoo Keeper: Characteristics of Zoo Keeper, Zoo keeper Services, Zoo keeper Data Model.

UNIT III

Map Reduce and YARN
YARN: Elements of YARN Architecture, Map Reduce: Characteristics of Map Reduce, Phasesof Map Reduce with an Example, Anatomy of MR Job Run with YARN, Handling Failures, Task Execution, Map Reduce Input and Output Formats, Shuffle and Sort, Built - in Countersof MR, Joins in MR,

UNIT IV

Data Ingestion Tools and PIG

Data Ingestion Tools: Data Ingestion, Big Data Ingestion Tools, SQOOP - Benefits of SQOOP, SQOOP Connectors, Importing and Exporting to and from Hadoop using SQOOP, Limitationsof SQOOP, FLUME – Apache Flume, Data Sources for FLUME, Components of FLUME Architecture.

PIG: Introduction to PIG, Components of PIG, Data Types in PIG – Simple and Complex, PIG Execution Modes, PIG Interactive Modes, Comparison of PIG with databases, Data Processing Operators.

UNIT V

HIVE and HBASE

HIVE: Features of HIVE, HIVE Architecture, HIVE Meta store, Data types in HIVE,HIVEQL, Tables, File Format Types – Text, Sequence, AVRO, Parquet, Querying Data.

HBASE: NOSQL Database, Types of NOSQL Database, Characteristics of HBASE,Architecture, HBaseVs. RDBMS, HBASE Shell Commands.

Text Books:

1. Tom White "Hadoop: The Definitive Guide" 4thedition, O'reily Media,2012.
2. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley2015

Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer,2007.
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRCpress(2013)
3. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw- Hill/Osborne Media (2013), Oracle press.
4. AnandRajaraman and Jefrey David Ulman, "Mining of Massive Datasets",Cambridge University Press, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons,2012.
6. Glen J. Myat, "Making Sense of Data", John Wiley & Sons,2007
7. Pete Warden, "Big Data Glossary", O'Reily,2011.
8. Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics:Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
9. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game",MC Press,2012
10. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles, David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ",Tata McGraw Hill Publications,2012.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VI

Course Code	Course Name	L	T	P	C
20CD6T03	NEURAL NETWORKS AND DEEP LEARNING	3	0	0	3

Course Objectives:

1. Comprehend the math required for building deep learning networks.
2. Understand the basic building blocks of artificial neural networks (ANNs).
3. Acquire knowledge of supervised/unsupervised learning in neural networks.
4. Explore the methods to develop optimized deep learning networks considering hyper parameters of convolution networks, recurrent neural networks.
5. Model solutions for real life problems using optimized deep learning networks.

Course Outcomes:

1. Understand the basic math required for neural network.
2. Explain working of artificial neural networks.
3. Categorize between supervised and unsupervised learning mechanisms.
4. Analyze the real world problem and identify required hyper parameters to be considered for a deep learning network.
5. Design optimized deep learning applications for small problems using algorithms learnt in the course.

UNIT I

Artificial Neural Networks: Introduction Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks

UNIT II

Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks

UNIT III

Introduction to Deep Learning: Historical Trends in Deep learning, Deep Feed – forward networks, Gradient-Based learning, Hidden Units, Architecture Design, Back- Propagation and Other Differentiation Algorithms

UNIT IV

Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier.

UNIT V

Optimization for Train Deep Models: Challenges in Neural Network Optimization,Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second- Order Methods, Optimization Strategies and Meta-Algorithms **Applications**: Large-Scale Deep Learning, Computer Vision, image classification, Speech Recognition, Natural Language Processing

Text Books:

1. Deep Learning –Ian Good fellow, Yoshua Bengio, AaronCourville—MIT Press book-ISBN-13: 978-0262035613,
2. Neural Networks a Comprehensive Foundations, Simon Haykin, PHIedition

Reference Books:

1. Artificial Neural Networks – B. Vegnanarayana Prentice Hall of India P Ltd2005
2. Neural Networks in Computer Intelligence, Li Mm Fu TMH2003
3. Deep Learning Fundamentals: An Introduction for Beginners by Chao Pan , AI Sciences Publisher.
4. Pattern Recognition and Machine Learning - Christopher M. Bishop -Information
5. Science and Statistics. ISBN-13:978-1493938438

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VI

Course Code	Course Name	L	T	P	C
20CD6E21	COMPILER DESIGN Professional Elective – 2	3	0	0	3

Course Objectives:

1. Use the knowledge of Finite Automata and able to represent the language in form of Regular Expressions, Grammar and convert NFA to DFA and vice versa.
2. Understand different phases of the compiler, Lexical analyser and Top down parsing.
3. Demonstrate Bottom up parsing technique.
4. Illustrate memory management techniques during different phases.
5. Identify the effectiveness of optimization and differences between machine dependentand independent translation

Course Outcomes:

1. Acquire knowledge in different phases and passes of Compiler, and specifying different
2. types of tokens by lexical analyzer, and also able to use the Compiler tools like LEX.
3. Parser and its types i.e. Top-down and Bottom-up parsers.
4. Construction of SLR, CLR and LALR parse table.
5. Syntax directed translation, synthesized and inherited attributes.
6. Techniques for code optimization.

UNIT I

Language Processors: Introduction Language Processing, Structure of a compiler, Boot strapping. **Lexical Analysis**-: The role of lexical analysis, Input buffing, specification of tokens. Recognitions of tokens, the lexical analyzer generator LEX tool.

UNIT II

Syntax Analysis -: The Role of a parser, Context free Grammar, Top-Down Parsing - Recursive and Non recursive top down parsers, Bottom-Up Parsing - Shift Reduce parser, Using Ambiguous Grammars.

UNIT III

Introduction to LR parsers -SLR, CLR and LALR. Syntax Directed Transactions Definition, Evolution order of SDTS Application of SDTS. Syntax Directed Translation Schemes.

UNIT IV

Intermediate-Code Generation: Variants of Syntax Trees, DAG, Three-Address Code, Control Flow, Back patching. **Run-Time Environments**: Storage organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection.

UNIT V

Code optimization: Machine-Independent Optimizations, **Code generation – Issues** in design of code generation, Code generation algorithm, Machine dependent optimizations, Register Allocation and Assignment, Basic blocks and Flow graphs..

Text Books:

1. Compilers, Principles Techniques and Tools.Alfred V Aho, Monical S. Lam, Ravi Sethi
2. Jeffery D. Ullman,2nd edition,pearson,2007
3. Compiler Design K.Muneeswaran, OXFORD
4. Principles of compiler design,2nd edition,Nandhini Prasad,Elsebier.

Reference Books:

1. Modern Compiler Construction in C , Andrew W.Appel Cambridge University Press.
2. Compiler Construction ,LOUDEN, Thomson.
3. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V.Raghavan, TMH.
5. Engineering a Compiler, K. D. Cooper, L.Torczon, ELSEVIER.
6. Introduction to Formal Languages and Automata Theory and Computation - Kamala Krithivasan and RamaR, Pearson.
7. Modern Compiler Design, D. Grune and others,Wiley-India.
8. A Text book on Automata Theory, S. F. B. Nasir, P. K. Srimani, Cambridge Univ. Press.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VI

Course Code	Course Name	L	T	P	C
20CD6E22	SOFTWARE PROJECT MANAGEMENT Professional Elective – 2	3	0	0	3

Course Objectives:

1. To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
2. To compare and differentiate organization structures and project structures
3. To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

Course Outcomes:

1. Apply the process to be followed in the software development life-cycle models.
2. Apply the concepts of project management & planning.
3. Implement the project plans through managing people, communications and change
4. Conduct activities necessary to successfully complete and close the Software projects
5. Implement communication, modelling, and construction & deployment practices in software development.

UNIT I

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections

UNIT II

The Old Way and The New: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Life Cycle Phases: Engineering and production stages, inception, Elaboration, construction, transition phases. Artifacts of The Process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT III

Model Based Software Architectures: A Management perspective and technical perspective.

Work Flows of the Process: Software process workflows, Iteration workflows.

Checkpoints of the Process: Major mile stones, Minor Milestones, Periodic status assessments.

UNIT IV

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning. Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

UNIT V

Process Automation: Automation Building blocks, The Project Environment. Project Control and **Process Instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation. Project Estimation and Management: COCOMO model, Critical Path Analysis, PERT technique, Monte Carlo approach (Text book 2).

Text Books:

1. Software Project Management, Walker Royce, Pearson Education, 2005.
2. Software Project Management, Bob Hughes, 4th edition, Mike Cotterell, TMH

Reference Books:

1. Software Project Management, Joel Henry, Pearson Education.
2. Software Project Management in practice, Pankaj Jalote, Pearson Education, 2005.
3. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VI

Course Code	Course Name	L	T	P	C
20CD6E23	DISTRIBUTED SYSTEMS Professional Elective – 2	3	0	0	3

Course Objectives:

1. Provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission, IPC mechanisms in distributed systems, Remote procedure calls.
2. Expose students to current technology used to build architectures to enhance distributed Computing infrastructures with various computing principles

Course Outcomes:

1. Develop a familiarity with distributed file systems.
2. Describe important characteristics of distributed systems and the salient architectural features of such systems.
3. Describe the features and applications of important standard protocols which are used in distributed systems.
4. Gaining practical experience of inter-process communication in a distributed environment

UNIT I

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. **System Models:** Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

UNIT II

Interprocess Communication: Introduction, The API for the Internet Protocols- The Characteristics of Interprocess communication, Sockets, UDP Datagram Communication, TCP Stream Communication; **External Data Representation and Marshalling**; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast

UNIT III

Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects- Object Model, Distributed Object Modal, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

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UNIT IV

Operating System Support: Introduction, The Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads.

UNIT V

Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays. **Coordination and Agreement:** Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication

Text Books:

1. Ajay D Kshemkalyani, MukeshSighal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, Pearson Publication

Reference Books:

1. Distributed-Systems-Principles-Paradigms-Tanenbaum PHI

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VI

Course Code	Course Name	L	T	P	C
20CD6E24	FUNDAMENTALS OF ROBOTICS Professional Elective – 2	3	0	0	3

Course Objectives:

1. Understanding basic concepts of robots and their development.
2. Knowledge of various configuration of robots used in industry, role of robots in industrial automation.
3. Analyze the forces acting on gripper and selection and design of grippers, actuators and sensors.
4. Transformation of motion of robot end effector with Denavit and Hartenberg parameters.
5. Apply Euler-Lagrange and Newton-Euler equations of motion are used for finding force and torque required at each of the joint actuators.

Course Outcomes:

1. Configure various robots with the help of given or required motions.
2. Apply motion of end effector and calculate the forward kinematics and inverse kinematics of serial and parallel robots.
3. Knowledge and analysis skills associated with trajectory planning.
4. Familiarized with the kinematic motions of robot and robot dynamics
5. Apply robot for various applications in manufacturing

UNIT I

Introduction, Automation and Robotics: An overview of Robotics-classification by coordinate system and control systems.

Components of the Industrial Robotics: Degrees of freedom – End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General Consideration on gripper selection and design, Robot actuators and sensors, RPA architecture.

UNIT II

Motion Analysis: Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and axis – Homogeneous transformation – Problems.

Manipulator Kinematics: D-H notations – joint coordinates and world coordinates – Forward and inverse kinematics – problems.

UNIT III

Differential Kinematics: Differential Kinematics of planar and spherical manipulators – Jacobians – problems.

Robot Dynamics: Lagrange – Euler formulations – Newton-Euler formulations – Problems on planar two link manipulators.

UNIT IV

Trajectory Planning: Joint space scheme – cubic polynomial fit – Avoidance of obstacles – **Types of motion: Slew motion** – joint interpolated motion – straight line motion – problems. Robot actuators and Feedback components: Actuators: Pneumatic.

UNIT V

Robot Application in Manufacturing: Material handling – Assembly and Inspection-Work cell design, work volume, Robot screen

Text Books:

1. M.P. Groover, "Industrial Robotics", PearsonEdu.
2. Introduction to Robotic Mechanics and Control / JJ Craig / Pearson / 3rdedition

Reference Books:

1. Robotics / Fu K S / McGrawHill.
2. Robotics Engineering / Richard D. Klaftez / PrenticeHall.
3. Robot Analysis and intelligence / Asada and Slotine / Wiley InterScience.
4. Robot Dynamics & Control / Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pvt. Ltd.
5. Robotics and Control / Mittal R K & Nagrath I J /TMH.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VI

Course Code	Course Name	L	T	P	C
20GE6C03	INTELLECTUAL PROPERTY RIGHTS AND PATENTS (IPR& P)	2	0	0	0

Course Objectives:

1. To know the importance of Intellectual property rights, which plays a vital role in Advanced Technical and Scientific disciplines.
2. Imparting IPR protections and regulations for further advancement, so that the Students can familiarize with the latest developments

Course Outcomes:

1. Identify different types of intellectual property rights may be prescribed by an output with supporting agencies internationally.
2. Explain the ways to protect literary and artistic works of the authors
3. Illustrate the process of registering innovative products i.e., Patents.
4. Analyze the ways to maintain of Trade Marks.
5. Suggest the ways to protect trade secrets in the organizations Explain different laws available related to cybercrimes.

UNIT – I: Introduction to Intellectual property
Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights

UNIT – II: Law of Copyrights:
Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

UNIT – III: Law of Patents:
Foundation of patent law, patent searching process, ownership rights and transfer. Patent litigation. Dilution of patent rights, patent registration.

UNIT – IV: Trade Marks:
Purpose and function of trademarks, acquisition of trade mark rights, protectable matter (strength and categories of trade marks), selecting, and evaluating trade mark, trade mark registration processes.

UNIT - V: Trade Secrets and Cyber law:
Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secretes litigation. Introduction to Cyber Law – Information Technology Act 2000 & Cyber Crimes & its types.
Real time examples must be added to the concepts requires.

REFERENCES:

1. Intellectual property right, Deborah, E. Bouchoux, Cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, Tata Mc- Graw Hill Publishing Company Ltd.
3. Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
4. Cyber Law - Texts & Cases, South-Western's Special Topics Collections

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VI

Course Code	Course Name	L	T	P	C
20CD6L01	COMPUTER NETWORKS LAB	0	0	3	1.5

Course Objectives:

• Understand and apply different network commands

• Analyze different networking functions and features for implementing optimal solutions Apply different networking concepts for implementing network solution

• Implement different network protocols

Course Outcomes:

CO-1: Apply the basics of Physical layer in real time applications

CO-2: Apply data link layer concepts, design issues, and protocols

CO-3: Apply Network layer routing protocols and IP addressing

CO-4:Implement the functions of Application layer and Presentation layer paradigms and Protocols

Experiments:

1) Implement the data link layer framing methods such as character stuffing and bit stuffing.

2) Write a C program to develop a DNS client server to resolve the given hostname.

3) Implement on a data set of characters the three CRC polynomials – CRC-12, CRC-16 and CRC-CCIP.

4) Implement Dijkstra's algorithm to compute the Shortest path in a graph.

5) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

6) Take an example subnet of hosts. Obtain broadcast tree for it.

7) Write a client-server application for chat using UDP

8) Implement programs using raw sockets (like packet capturing and filtering)

9) Write a C program to perform sliding window protocol.

10) Get the MAC or Physical address of the system using Address Resolution Protocol.

11) Simulate the Implementing Routing Protocols using border gateway protocol(BGP)

12) Simulate the OPEN SHORTEST PATH FIRST routing protocol based on the cost assigned to the path.

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Course Code	Course Name	L	T	P	C
20CD6L02	BIG DATA & HADOOP LAB	0	0	3	1.5

Course Objectives:

1. Provide the knowledge to setup a Hadoop Cluster.
2. Impart knowledge to develop programs using MapReduce.
3. Discuss Pig, PigLatin and HiveQL to process bigdata.
4. Present latest big data frameworks and applications using Spark
5. Integrate Hadoop with R (RHadoop) to process and visualize.

Course Outcomes:

1. Understand Hadoop working environment.
2. Apply Map Reduce programs for real world problems.
3. Implement scripts using Pig to solve real world problems.
4. Analyze queries using Hive to analyze the datasets
5. Understand spark working environment and integration with R

TASK 1: a) Understanding and using basic HDFS commands
b) Run a basic word count Map Reduce program to understand Map Reduce Paradigm.
TASK 2: Write a Map Reduce program that mines weather data
TASK 3: Implement matrix multiplication with Hadoop Map Reduce.
TASK 4: Working with files in Hadoop file system: Reading, Writing and Copying
TASK-5: Write Pig Latin scripts sort, group, join, project, and filter your data.
TASK 6: Run the Pig Latin Scripts to find Word Count and max. temp for each and every year.
TASK-7: Writing User Defined Functions/Eval functions for filtering unwanted data in Pig
TASK-8: Working with Hive QL, Use Hive to create, alter, and drop databases, tables, views, functions, and indexes
TASK 9: Writing User Defined Functions in Hive
TASK 10: Understanding the processing of large dataset on Spark framework.
TASK 11: Ingesting structured and unstructured data using Sqoop, Flume
TASK 12: Integrating Hadoop with other data analytic framework like R

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Inc,2015.
2. Tanmay Deshpande, "Hadoop Real-World Solutions Cookbook", 2ndEdition, Packt Publishing, 2016

Reference Books:

1. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Inc,2012.
2. Vignesh Prajapati, "Big data Analytics with R and Hadoop", Packt Publishing,2013

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E31	NATURAL LANGUAGE PROCESSING Professional Elective – 3	3	0	0	3

Prerequisites:
Students are expected to have knowledge in Formal Languages and Automata Theory, Compiler Design

Course Objectives:
1. Role of natural language processing and language modelling.
2. The analysis of text at word level, syntactic level and semantic level.
3. Discourse processing of the text.
4. Knowledge in automated natural language generation and machine translation.
5. Explanation of information retrieval systems and usage of Lexical resources.

Course Outcomes:
1. Summarize the role of natural language processing in various applications and explain language modeling.
2. Apply word level analysis, syntactic analysis and semantic analysis on natural language processing.
3. Discuss discourse processing of text.
4. Illustrate the automation of natural language generation and machine translation of Indian languages.
5. Infer information retrieval systems and utilize lexical resources for processing natural language text.

UNIT I
Overview: Origins and challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Information Retrieval.
Language Modeling: Introduction, Various Grammar-based Language Models, Statistical Language Model.

UNIT II
Information Retrieval: Introduction, Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, Evaluation
Lexical Resources: Introduction, WordNet, Frame Net, Stemmers, POS Tagger, Research Corpora

UNIT III

Word Level Analysis: Introduction, Regular Expressions, Finite State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part of Speech Tagging, TF, IDF

Syntactic Analysis: Introduction, Context-free Grammar, Constituency, Parsing, Probabilistic Parsing.

UNIT IV

Semantic Analysis: Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation.

Discourse Processing: Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure.

UNIT V

Natural Language Generation: Introduction, Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG.

Machine Translation: Introduction, Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition",Prentice Hall, 2nd Edition,2008.
2. James Allen, Bejamin/cummings, "Natural Language Understanding", 2ndedition,1995.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E32	CRYPTOGRAPHY AND NETWORK SECURITY Professional Elective – 3	3	0	0	3

Pre Requisites:

Students should have good knowledge in Computer Networks

Course Objectives:

1. Importance and applications of confidentiality, integrity, authentication, availability.
2. Develop various cryptographic algorithms, related to conventional and asymmetric encryption.
3. Familiarize how to generate and distribute PGP key pair and use the PGP package to send and encrypted E-mail message.
4. Understand the public-key cryptosystem and enhancements made to IPV4 by IPSec.
5. Understand with intrusion and intrusion detection / web security and Firewalls

Course Outcomes:

1. Work and check the applications defined with confidentiality, integrity, and authentication.
2. Work with various public key and private key cryptographic algorithms.
3. Examine the issues and structure of Authentication Service and Electronic Mail Security.
4. Understand the IP Security Architecture, Web Security and Key Management techniques.
5. Understand intrusion and intrusion detection, Web security and firewalls

UNIT I

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) Security Mechanisms, a model for Internetwork security.

Conventional Encryption Principles, substitution ciphers, transposition ciphers.

UNIT II

Conventional encryption algorithms (DES, Blowfish, Idea), cipher block modes of operation, location of encryption devices, key distribution.

Public key cryptography principles, public key cryptography algorithms (RSA, Diffie- Hellman, ECC), digital signatures, digital certificates, certificate authority and key management.

UNIT III

Approaches of Message Authentication, Secure Hash Functions(MD-5,SHA-1) and HMAC. Kerberos, X.509 Directory Authentication Service.

Email privacy: Pretty Good Privacy (PGP), MIME,S/MIME.

UNIT IV

IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management, Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

UNIT V

Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3, Intruders, Viruses and related threats, firewall Design principles, Trusted System, Intrusion Detection Systems.

Text Books:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and RyanPermeh, wiley Dreamtech

Reference Books:

1. Fundamentals of Network Security by Eric Maiwald (Dreamtechpress)
2. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner,Pearson/PHI.
3. Cryptography and network Security, Third edition, Stallings,PHI/Pearson
4. Principles of Information Security, Whitman,Thomson.
5. Network Security: The complete reference, Robert Bragg, MarkRhodes,TMH
6. Introduction to Cryptography, Buchmann,Springer.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E33	IMAGE AND VIDEO PROCESSING Professional Elective – 3	3	0	0	3

Pre requisites:
Students are expected to have knowledge in Analysis of algorithms and linear algebra. Programming experience.

Course Objectives:
1. Describe and explain basic principles of digital image processing.
2. Cover the basic analytical methods such as image enhancement ,restoration, segmentation
3. Learn image compression techniques
4. Learn and explain basic principles of digital image and video processing.
5. Cover the basic motion estimations used in video processing

Course Outcomes:

1. Describe the basic principles of Imaging.
2. Learn the knowledge of the images in transform domains and segmentation.
3. Apply image compression on images.
4. Understand and develop algorithms video processing.
5. Implement various video motion techniques

UNIT I
Fundamentals of Image Processing and Image Transforms: Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels

UNIT II
Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, Image smoothing, Image sharpening, Selective filtering.
Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Thres holding, Region based segmentation.

UNIT III
Image Compression: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy& Lossless, Huffman coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, JPEG Standards.

UNIT IV

Basic Steps of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, filtering operations.

UNIT V

2-D Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Application of motion estimation in Video coding.

Text Books:

1. Digital Image Processing – Gonzalez and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, Joem Oysterman and Ya–quin Zhang. 1st Ed., PHInt

Reference Books:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – Scotte Umbaugh, 2nd Ed, CRCPress,2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International
3. Digital Image Processing with MATLAB and Lab view – VipulaSingh,Elsevier
4. Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5th Ed.,Elsevier

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SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E34	BLOCK CHAIN TECHNOLOGIES Professional Elective – 3	3	0	0	3

Course Objectives:

1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work,
2. To securely interact with them,
3. Design, build, and deploy smart contracts and distributed applications,
4. Integrate ideas from blockchain technology into their own projects.
5. Explaining design principles of Bitcoin and Ethereum and Nakamoto consensus

Course Outcomes:

1. Learn the Simplified Payment Verification protocol.
2. List and describe differences between proof-of-work and proof-of-stake consensus.
3. Interact with a blockchain system by sending and reading transactions.
4. Design, build, and deploy a distributed application.
5. Evaluate security, privacy, and efficiency of a given blockchain system

UNIT I

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

UNIT II

Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

UNIT III

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

UNIT IV

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

UNIT V

Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy.

Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Tutorial & Practical: Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles.

Text Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016)
2. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies

Reference Books:

1. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
2. Dr. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
3. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E41	ARTIFICIAL INTELLIGENCE Professional Elective – 4	3	0	0	3

Course Objectives:

1. Understand both the achievements of AI and the theory underlying those achievements. Infer different searching strategies that are suitable for the problem to be solved
2. Recognize the ways to represent knowledge and infer resolution using prepositional and first order logic.
3. Understand the representation of uncertain knowledge and conditional distributions using Bayesian networks.
4. Comprehend the principles of temporal models, hidden markov models, decision trees.
5. Enable the student to apply artificial intelligence techniques in applications which involve perception, reasoning and learning.

Course Outcomes:

1. Select an appropriate searching strategy for developing intelligent agents to find solution in optimized way using building blocks of AI.
2. Apply prepositional and first order logic methods to resolve decisions for knowledge based agents.
3. Practice uncertain knowledge and reasoning handling using Bayesian networks
4. Analyze the working of temporal models, hidden Markova models, decision trees.
5. Write AI programs and construct small robots capable of performing perception and movement based on techniques learnt in the course.

UNIT I

Introduction to AI: Introduction, Foundation of AI, History of Intelligent Agents, Agents and environments, Concept of Rationality, Nature of environments & Structure of Agents, Problem solving agents and formulation, Searching For Solutions and Strategies, Uninformed search strategies BFS, DFS, Heuristic approach, Greedy best search, A* Search, Game Playing: Adversal search, Games, Min-Max algorithm, Optimal decisions in multiplayer games, Alpha Beta pruning.

UNIT II

Knowledge Representation & Reasons: Logical agents, Knowledge based agents, The Wumpus **world, Logic**: Proportional logic, Resolution patterns in proportional logics, Resolution: Forward and Backward chaining, First order logic: Inference in First order logic, Proportional vs first order inference, Unification & Lifting, forward chaining, Resolution, Practice problems.

UNIT III

Uncertain Knowledge and Reasoning: Uncertainty-Acting under uncertainty, Basic probability notion, the axioms of probability, inference using full joint distribution, Independence, Bayes' rule.

Probabilistic Reasoning: Representing Knowledge in uncertain domain, the semantics of Bayesian networks, efficient representations of conditional distributions, exact inference in Bayesian networks, approximate inference in Bayesian networks.

UNIT IV

Probabilistic reasoning over time: Time and uncertainty, inference in temporal model, Hidden Markov models.

Learning: Learning from observations: Forms of learning, inductive learning, learning decision trees, ensemble learning, why learning works.

UNIT V

Perception: Introduction, Early Image Processing operations- Edge detection, image segmentation. Object recognition, using vision for manipulation and navigation.

Robotics: Introduction, Robot hardware, robotic perception, planning to move, Robotic software architectures, application domains

Text Books:

1. Artificial Intelligence-A modern approach-by Staurt Russel, Peter Norvig, 2nd edition, PHI/Pearson.

Reference Books:

1. Artificial Intelligence – Riche &K.Night , 2ndeditionTMH.
2. Paradigms of Artificial intelligence programming, case studies in common lisp-Peter. Norvig, Morgan Kaufmann.ISBN-13:978-1558601918.
3. Robotics: Fundamental Concepts and Analysis –Ashitava Goshal, oxford.
4. A Textbook of Robotics 1-Basic Concepts-M. Shoham-Springer US

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E42	CLOUD COMPUTING Professional Elective – 4	3	0	0	3

Course Objectives:

1. Understand the current trend and basics of cloud computing.
2. Learn cloud services from different providers.
3. Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
4. Understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization
5. Learn basic concepts of MapReduce programming models for big data analysis on cloud

Course Outcomes:

6. Understand the features, advantages and challenges of cloud computing, compare their operation ,implementation and performance
7. Understand, Analyze and compare different types of clouds and cloud services.
8. Understanding and validating the financial and technological implications in selecting cloud computing paradigm for an organization.
9. Understand and Analyze the security challenges and risks involved in the cloud.
10. Create/Deploying of an application in cloud

UNIT I

Understanding Cloud Computing: Cloud Computing, Introduction to Cloud Computing ,Cloud Architecture and Cloud Services(IaaS, PaaS, SaaS) , Cloud models– Public vs Private, Cloud Technologies for Network-Based System , System Models for Distributed and Cloud Computing , NIST Cloud Computing Reference Architecture

UNIT II

Virtualization: Basics of Virtualization , Types of Virtualization , Implementation Levels of Virtualization , Virtualization Structures , Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices , Virtual Clusters and Resource management , Virtualization for Data-center Automation.

UNIT III

Cloud Infrastructure: Architectural Design of Compute and Storage Clouds , Layered Cloud Architecture Development , Design Challenges , Inter Cloud Resource Management , Resource Provisioning and Platform Deployment , Global Exchange of Cloud Resources.

UNIT IV

Programming Model: Parallel and Distributed Programming Paradigms , Map Reduce, Twister and Iterative Map Reduce , Hadoop Library from Apache , Mapping Applications , Programming Support ,Google App Engine, Amazon AWS , Cloud Software Environments, Eucalyptus, Open Nebula, Open Stack, Aneka, CloudSim

UNIT V

Security in the Cloud: Security Overview , Cloud Security Challenges and Risks , Software- as-a- Service Security , Security Governance , Risk Management , Security Monitoring , Security Architecture Design , Data Security , Application Security , Virtual Machine Security, Identity Management and Access Control , Autonomic Security.

Text Books:

2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud"O'Reilly.
3. Kumar Saurabh, " Cloud Computing , insights into New-Era Infrastructure", Wiley India,2011
4. RajkumarBuyya, Christian Vecchiola, S.TamaraiSelvi, 'Mastering Cloud Computing", TMGH,2013.

Reference Books:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press,2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH,2009.
4. Ronald L. Krutz, Russell Dean Vines, "Cloud Security, A comprehensive Guide to Secure Cloud Computing", Wiley , India,2010.
5. Nick Antonopoulos, Cloud computing, Springer Publications, 2010

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E43	COMPUTER VISION Professional Elective – 4	3	0	0	3

Course Objectives:

1. Understanding basic concepts of image processing and their development.
2. Knowledge of various configuration of image processing techniques used in industry, role in industry
3. To Know the application areas.
4. To implement fundamental image processing techniques required for computer vision
5. Understand Image formation process

Course Outcomes:

1. To perform shape analysis
2. Extract features form Images and do analysis of Images
3.Generate 3D model from images
4 To develop applications using computer vision techniques
5.Understand video processing, motion computation and 3D vision and geometr

UNIT I

Introduction : Image Processing, Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.

UNIT II

Image Formation Models : Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, orthographic & Perspective Projection,• Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination. shape from shading , Photometric Stereo, Depth from Defocus , Construction of 3D model from images.

UNIT III

Shape Representation and Segmentation : Contour based representation, Region based representation, Deformable curves and surfaces , Snakes and active contours, Level set representations , Fourier and wavelet descriptors , Medial representations , Multi resolution analysis.

UNIT IV

Object recognition : Hough transforms and other simple object recognition methods, Shape correspondence and shape matching Principal component analysis , Shape priors for recognition Image Understanding : Pattern recognition methods, HMM, GMM and EM.

UNIT V

Applications: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters –Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Text Books:

1.Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

Reference Books:

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010
4. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
5. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012
6. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012
7. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E44	HUMAN COMPUTER INTERACTION Professional Elective – 4	3	0	0	3

Course Objectives:

1. The basic understanding of guidelines, principles, and theories influencing human computer interaction.
2. The knowledge of how a computer system may be modified to include human diversity.
3. The appropriate evaluation of human computer interaction system.
4. Select an effective style for a specific application.
5. The basic concepts of User Experience Design and the factors that influence the user experience.

Course Outcomes:

1. Learn the concepts of interaction design and how it relates to human computer interaction and other fields.
2. Design how technologies can be to change people's attitudes and behavior.
3. Apply the difference between qualitative and quantitative data and analysis.
4. Extract the social Mechanisms that are used by people to communicate and collaborate.
5. Explore the user Experience design and analyze the factors involved in design

UNIT I

Introduction: Importance of user Interface, definition, importance of good design. Benefits of good design, a brief history of Screen design.

The graphical user interface: popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user, Interface popularity, characteristics, Principles of user interface.

UNIT II

Design process: Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions

UNIT III

Screen Designing : Design goals, Screen planning and purpose, organizing screen elements, ordering of screen emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.

UNIT IV

Develop System Menus and Navigation Schemes: Select the Proper Kinds of Windows, Select the Proper Device, Based Controls , Choose the Proper Screen Based Controls.

Interaction Devices: Keyboard and function keys, speech recognition digitization and generation, Image and video displays, drivers

UNIT V

A Brief Introduction to User Experience (UX) Design: Complexity and perception, What is User Experience (UX), What is a UX Designer

What is Design Thinking and Why is it so Popular: What is Design Thinking, Design Thinking's Phases

The 7 factors that influence user experience: Useful, Usable, An introduction to usability, Why does usability matter, The 5 Characteristics of usable products How to conduct user interviews, What is User Interview, Preparing for user interview, How to conduct a user interview, Reporting on user interview What is interaction design?-Understanding of Interaction design, The 5 Dimensions of interaction design.

Text Books:

1. The essential guide to user interface design, Wilbert O Galitz, WileyDreamaTech.
2. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson EducationAsia.
3. The basics of User Experience design, Interaction designfoundation2002

Reference Books :

1. Human Computer Interaction. Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg, Pearson.
2. Interaction Design PRECE, ROGERS, SHARPS. WileyDreamtech,
3. User Interface Design, SorenLauesen, PearsonEducation.
4. User Experience for Beginners, JoelMarsh.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E51	SOCIAL NETWORK ANALYSIS Professional Elective – 5	3	0	0	3

Course Objectives:

1. Formalize different types of entities and relationships as nodes and edges and represent this information as relational data
2. Plan and execute network analytical computations
3. Use advanced network analysis software to generate visualizations and perform empirical investigations of network data
4. Interpret and synthesize the meaning of the results with respect to a question, goal, or task
5. Collect network data in different ways and from different sources while adhering to legal standards and ethics standards

Course Outcomes:

1. Know basic notation and terminology used in network science
2. Be able to visualize, summarize and compare networks
3. Illustrate basic principles behind network analysis algorithms
4. Develop practical skills of network analysis in R programming language
5. Be capable of analyzing real work networks

UNIT I

Social Network Analysis: Preliminaries and definitions, Erdos Number Project, Centrality measures, Balance and Homophily.

UNIT II

Random graph models**:** Random graphs and alternative models, Models of network growth, Navigation in social Networks, Cohesive subgroups, Multidimensional Scaling, Structural equivalence, roles and positions.

UNIT III

Network topology and diffusion, Contagion in Networks, Complex contagion, Percolation and information, Navigation in Networks Revisited.

UNIT IV

Small world experiments, small world models, origins of small world, Heavy tails, Small Diameter, Clustering of connectivity, The ErdosRenyi Model, Clustering Models.

UNIT V

Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, network formation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.

Text Books:

1. S. Wasserman and K. Faust. "Social Network Analysis: Methods and Applications", Cambridge University Press.
2. 2) D. Easley and J. Kleinberg, "Networks, Crowds and Markets: Reasoning about a highly connected world" , Cambridge University Press, 1st edition,2010

Reference Books:

1. Maarten van Steen. "Graph Theory and Complex Networks. An Introduction", 2010.
2. Reza Zafarani, Mohammed Ali Abbasi, Huan Liu. "Social Media Mining: An Introduction". Cambridge University Press 2014.
3. Maksim Tsvetovat and Alexander Kouznetsov. "Social Network Analysis for Startups". O'Reilly Media, 2011.

e-Resources:

https://www.classcentral.com/course/edx-social-network-analysis-sna-9134
https://www.coursera.org/learn/social-network-analysis

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E52	RECOMMENDER SYSTEMS Professional Elective – 5	3	0	0	3

Course Objectives:

1. To learn techniques for making recommendations, including non-personalized, content-based, and collaborative filtering.
2. To automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations.

Course Outcomes:

1. Design recommendation system for a particular application domain
2. Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity

UNIT I

Introduction: Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

UNIT II

Content-based Filtering: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

UNIT III

Collaborative Filtering: User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

UNIT IV

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

UNIT V

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations. Types of Recommender Systems: Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems.

References:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
2. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1st ed.
3. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.
4. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E53	DATA VISUALIZATION Professional Elective – 5	3	0	0	3

Course Objectives:

1. Understand the visualization process and visual representations of data.
2. Learn visualization techniques for various types of data.
3. Explore the visualization techniques for graphs, trees, Networks.
4. Understand the visualization of maps, GIS and collaborative visualizations.
5. Discuss the recent trends in perception and visualization techniques

Course Outcomes:

1. Apply the visualization process for creating visual representations.
2. Classify visualization techniques for different types of data.
3. Analyze visualization methods for graphs, trees, Networks.
4. Apply visualization techniques for GIS , maps and use collaborative visualization.
5. Summarize the recent trends in visualization techniques and their applications for real world problems.

UNIT I

Introduction to Visualization, Visualization process, visual representation of data, Gestalt principles, information overloads. Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

UNIT II

Introduction to Tableau, Tableau Architecture, Tableau Server Architecture VizQL, Introduction to Tableau Prep, Tableau Prep Builder User Interface, Data Preparation techniques using Tableau Prep Builder tool, Features of Tableau Desktop Connect to data from File and Database, Types of Connections, Joins and Unions, Data Blending, Tableau Desktop User Interface.

UNIT III

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents. Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization.

UNIT IV

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations.

UNIT V

Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.

Text Books:

1. Matthew Ward Georges Grinstein Daniel Keim , Interactive Data Visualization: Foundations, Techniques, and Applications. A K Peters, Ltd. Natick.
2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.
3. Joshua N. Milligan, Learning Tableau 2019 Tools for Business Intelligence, data prep, and visual analytics, Third edition.

Reference Books:

1. Data Visualization: A Handbook for Data Drive by AndyKirk
2. Hand book of data visualization ,chun-houh chen,wolfgang hardle,Antonyunwin

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20CD7E54	TEXT MINING Professional Elective – 5	3	0	0	3

Course Objectives:

1. To compare and contrast methods for sentence segmentation, tokenisation, part-of-speech tagging, syntactic parsing and semantic representation
2. To apply techniques such as named entity recognition, entity linking, relation and event extraction.
3. To extract information from text, while leveraging resources such as lexical and semantic resources (e.g. Framenet, VerbNet, WordNet), and terminological repositories.
4. To design and customise text annotation workflows, taking into consideration various annotation formats

Course Outcomes:

1. To explain how text mining supports the development of semantic search systems
2. To explain the distributional hypothesis, and to compare with each other (1) count-based and (2) compositional distributional semantics models
3. To apply various evaluation measures (e.g., Kappa, recall, precision and F-score)
4. To investigate methods for social media content analysis

UNIT I

Introduction:

Background, motivation, dealing with information overload and information overlook, unstructured vs. (semi-)structured data, evolving information needs and knowledge management issues, enhancing user experience of information provision and seeking, the business case for text mining.

The text mining pipeline: information retrieval, information extraction and data mining

UNIT II

Fundamentals of natural language processing: linguistic foundations, levels of linguistic analysis.

Approaches to text mining: rule-based vs. machine learning based vs. hybrid; generic vs. domain specific; domain adaptation.

UNIT III

Dealing with real text: text types, document formats and conversion, character encodings, markup, low-level processes (sentence splitting, tokenisation, part of speech tagging, chunking).

Information extraction: term extraction, named entity recognition, relation extraction, fact and event extraction; partial analysis vs. full analysis. Data mining and visualisation of results from text mining.

UNIT IV

Evaluation of text mining systems: evaluation measures, role of evaluation challenges, usability evaluation.

Resources for text mining: annotated corpora, computational lexica, ontologies, computational grammars; design, construction and use issues.

UNIT V

Issues in large scale processing of text: distributed text mining, scalable text mining systems. A sampler of text mining applications and services; **case studies.**

Text Books:

1. The text mining handbook : advanced approaches in analyzing unstructured data, Feldman, Ronen, 1962, Cambridge University Press, 2007.
2. Text mining for biology and biomedicine, 158053984X, Artech House, c2006.
3. Linked lexical knowledge bases : foundations and applications, Gurevych, Iryna author, Morgan & Claypool Publishers, 2016

Reference Books:

1. Handbook of linguistic annotation, Springer, 2017
2. Speech and language processing : an introduction to natural language processing, computational linguistics, and speech recognition, Jurafsky, Dan, 1962, Pearson/Prentice Hall, c2009.
3. An introduction to information retrieval, Manning, Christopher D., Cambridge University Press, 2008.
4. Text mining : classification, clustering, and applications, CRC, c2009.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - VII

Course Code	Course Name	L	T	P	C
20SH7T01	MANAGEMENT SCIENCE	3	0	0	3

Course Objectives:

1. To familiarize with the process of management and to provide basic insight into organizational behaviour
2. To provide conceptual knowledge on functional management and project management

Course Outcomes:

1. After completion of the Course the student will acquire the knowledge on management functions, global leadership and organizational behaviour.
2. Will familiarize with the concepts of functional management project management and strategic management.

UNIT I

Introduction to Management: Concept –nature and importance of Management ––Generic Functions of Management- Administration vs. Management – Evolution of Management thought- Decision making process- organization structure: Principles of organization & its types.

UNIT II

Operations Management: production & its types, plant layout, Work study- method study and work measurement - Statistical Quality Control- Control charts -Simple problems
Material Management: Need for Inventory control- EOQ (simple problems), ABC analysis and Types of ABC analysis (HML, SDE, VED, and FSN analysis).

UNIT III

Planar and Dual Graphs: Planar graphs, Different representations of planar graphs, Detection of Planarity, Geometric dual, Combinatorial dual.

Matrix Representation of Graphs: Incidence Matrix, Circuit Matrix, Fundamental Circuit Matrix and Rank, Cut-Set Matrix, Path Matrix, Adjacency Matrix.

UNIT III:

Human Resource Management: Concept of HRM, HRD - Functions of HR Manager- types of Wage payment plans – Job Evaluation and Merit Rating - Grievance & redressal mechanism , Marketing Management: Functions of Marketing – Marketing Mix-Marketing strategies based on product Life Cycle, Channels of distribution.

UNIT-IV:

Project Management: (PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems).

UNIT V:

Organisational behaviour: Attitude & behaviour; Leadership styles; motivation- significance, theories; Perception-Perceptual process-Group Dynamics: Types of Groups, Stages of Group Development, Group Behaviour and Group Performance Factors.

Text Books

1. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Management Science' Cengage, Delhi, 2012.
2. Dr. A. R. Aryasri, Management Science' TMH 2011.
3. L. M. Prasad, 'Organisational Behavior' Sultan Chand Publications.

References:

1. Koontz & Weihrich: 'Essentials of management' TMH 2011
2. Anil Bhat& Arya Kumar : Principles of Management, Oxford University Press, New Delhi
3. Robbins: Organizational Behaviour, Pearson publications, 2011
4. Kanishka Bedi: Production & Operations Management, Oxford Publications, 2011
5. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications
6. K. Aswatappa: 'Human Resource Management – text & cases', TMH.

Course Code	Course Name	L	T	P	C
	Object Oriented Programming (C++) **Open Elective**	**3**	**0**	**0**	**3**

Course Objectives:

1. Introduce to the student the fundamentals of C++ language.
2. To make the students understand the principles of data abstraction, inheritance and polymorphism
3. To create awareness about generic programming and exception handling
4. To make the students familiar with IO streams, STL.

Course Outcomes:

1. Differentiate POP and OOP and then use C++ fundamentals and various function modifiers to create and manipulate classes and objects.
2. Make use of the advantages of Compile time polymorphism and also develop reusable programs by applying inheritance.
3. Use runtime polymorphism, generic programming and exception handling techniques for developing efficient programs.
4. Demonstrate C++ streams, Name Spaces and STL

UNIT I

An Overview of C++: The Origins of C++, What is Object Oriented Programming, some C++ fundamentals, Old-Style Vs Modern C++, Introducing C++ Classes, Operator Overloading, Inheritance, Constructors and Destructors, The C++ Keywords, The General Form of a C++ Program

Classes and Objects: Classes, Structures and Classes, Unions and Classes are Related, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Destructors, Scope Resolution Operator, Nested Classes, Local Classes, Passing and Returning Objects, Object Assignment, arrays of objects.

UNIT II

Function Overloading, Copy Constructors and Default Arguments: Function Overloading, Constructors types of constructors. Default Arguments.

Operator Overloading: Creating Member Operator Function, Overloading Using a Friend Function, Overloading new delete, Overloading Special Operators & Comma Operator

UNIT III

Inheritance: Base-Class Access Control, Inheritance and protected members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes.

UNIT IV

Virtual Functions & Polymorphism: Virtual Functions, The Virtual Attribute is inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early Vs Late Binding.

Templates: Generic Functions, Applying Generic Functions, Generic Classes, Typename and export Keywords, Power of Templates.

UNIT V

Exception Handling: Fundamentals, Derived-Class Exceptions, Options, Terminate() and unexpected(), uncaught_exception(), exception and bad_exception Classes, Applying Exception Handling.

Text Books:

1. The Complete Reference - C++ - Herbert Schieldt, 4/e, Tata McGraw Hill.

Reference Books:

1. Bjarne Stroustrup, "The C++ Programming Language", Special Edition, Pearson Education.
2. C++ - How to Program – Dietel & Dietel
3. Programming in C++ - Barkakati
4. Mastering C++ by Venugopal

DEPARTMENT OF CSE - DATA SCIENCE

Course Code	Course Name	L	T	P	C
	DATA WAREHOUSING AND MINING **Open Elective**	**3**	**0**	**0**	**3**

Course Objectives:

1. To understand and implement classical models and algorithms in data warehousing and data mining.
2. To analyse the data, identify the problems, and choose the relevant models and algorithms to apply.
3. To assess the strengths and weaknesses of various methods and algorithms and to analyse their behaviour.

Course Outcomes:

At the end of the Course, the student will be able to

1 : Summarize the architecture of data warehouse
2 : Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data.
3 : Construct a decision tree and resolve the problem of model over fitting
4 : Compare A priori and FP-growth association rule mining algorithms for frequent item set generation
5 : Apply suitable clustering algorithm for the given data set

UNIT- I

Data Warehouse and OLAP Technology: An Overview: What Is a Data Warehouse? A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining. (Han &Kamber).

UNIT- II

Data Mining: Introduction, What is Data Mining?, Motivating challenges, The origins of Data Mining, Data Mining Tasks, Types of Data, Data Quality.

Data Pre-processing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity. (Tan &Vipin).

UNIT -III

Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction.

Model Over fitting: Due to presence of noise, due to lack of representation samples, evaluating the performance of classifier: holdout method, random sub sampling, cross-validation, bootstrap. Bayes Theorem, Naïve Bayes Classifier (Tan &Vipin)

UNIT -IV

Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Item Set Generation, A priori Principle, A priori Algorithm, Rule Generation, Compact Representation of Frequent Item sets, FP- Growth Algorithm. (Tan & Vipin)

UNIT -V

Cluster Analysis: Basic Concepts and Algorithms: Overview, What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan &Vipin).

Text Books :

3. Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression,Pearson, 2015.
4. Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011

Reference Books:

5. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010
6. Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
7. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008
8. Data Mining Techniques, Arun K Pujari, Universities Press, 2001

Web Resources:

NPTEL Online Course on Data Mining : https://onlinecourses.nptel.ac.in/noc18_cs14/preview

DEPARTMENT OF CSE - DATA SCIENCE

Course Code	Course Name	L	T	P	C
	BIG DATA ANALYTICS OPEN ELECTIVE	**3**	**0**	**0**	**3**

Pre- Requisites:
Students should have knowledge of one Programming Language (Java preferably), Practiceof SQL (queries and sub queries), exposure to Linux Environment.

Course Objectives:

1. Describe Big Data and its use cases from selected business domains.
2. Provide an overview of HDFS Architecture and its daemon services.
3. Perform Map Reduce analytics with YARN using Hadoop.
4. Understand the working of data ingestion tools and PIG Latin.
5. Use Hadoop related tools such as Hive and HBase for big data analytics.

Course Outcomes:

At the end of the Course, the student will be able to

1. Understand the concepts of Big Data and navigation of the Hadoop Ecosystem.
2. Illustrate the HDFS Architecture and the coordination service of Hadoop.
3. Implement distributed processing Map Reduce Paradigm with YARN.
4. Analyze importing and exporting data from Hadoop using Sqoop, Flume and workingwith PIG.
5. Examine the data stores - Hive and HBase on Hadoop

UNIT I

Introduction to Big Data and Hadoop:
Challenges of Traditional Decision Making, Solution with Big Data Analytics, Classification of Digital Data, Definition of Big Data, Characteristics of Big Data, Definition of Big Data Analytics, Features of Hadoop, History of Hadoop, RDBMS Vs. Hadoop, Hadoop Distributors, Ecosystems of Hadoop.

UNIT II

HDFS and Zoo Keeper:
HDFS: Concepts – Blocks, HDFS Components, Block Caching, Characteristics of HDFS, HDFS High Availability Architecture and its types, HDFS Command Line, Data Flow – Anatomy of File read and File write operations.
Zoo Keeper: Characteristics of Zoo Keeper, Zoo keeper Services, Zoo keeper Data Model.

UNIT III

Map Reduce and YARN
YARN: Elements of YARN Architecture, Map Reduce: Characteristics of Map Reduce, Phasesof Map Reduce with an Example, Anatomy of MR Job Run with YARN, Handling Failures, Task Execution, Map Reduce Input and Output Formats, Shuffle and Sort, Built - in Countersof MR, Joins in MR,

UNIT IV

Data Ingestion Tools and PIG

Data Ingestion Tools: Data Ingestion, Big Data Ingestion Tools, SQOOP - Benefits of SQOOP, SQOOP Connectors, Importing and Exporting to and from Hadoop using SQOOP, Limitationsof SQOOP, FLUME – Apache Flume, Data Sources for FLUME, Components of FLUME Architecture.

PIG: Introduction to PIG, Components of PIG, Data Types in PIG – Simple and Complex, PIG Execution Modes, PIG Interactive Modes, Comparison of PIG with databases, Data Processing Operators.

UNIT V

HIVE and HBASE

HIVE: Features of HIVE, HIVE Architecture, HIVE Meta store, Data types in HIVE,HIVEQL, Tables, File Format Types – Text, Sequence, AVRO, Parquet, Querying Data.

HBASE: NOSQL Database, Types of NOSQL Database, Characteristics of HBASE,Architecture, HBaseVs. RDBMS, HBASE Shell Commands.

Text Books:

1. Tom White "Hadoop: The Definitive Guide" 4thedition, O'reily Media,2012.
2. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley2015

Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer,2007.
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRCpress(2013)
3. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw- Hill/Osborne Media (2013), Oracle press.
4. AnandRajaraman and Jefrey David Ulman, "Mining of Massive Datasets",Cambridge University Press, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons,2012.
6. Glen J. Myat, "Making Sense of Data", John Wiley & Sons,2007
7. Pete Warden, "Big Data Glossary", O'Reily,2011.
8. Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics:Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.