Curriculum and Syllabus

(Applicable to students admitted during AY 2020 – 2023)

BSc Computer Science (Hons.)

School of Engineering and Sciences

Department of BSc Computer Science
SRM UNIVERSITY – AP, Andhra Pradesh

SRM UNIVERSITY – AP, ANDHRA PRADESH
CURRICULUM FRAMEOWRK

PROGRAM: BSC Computers Honors
(For students admitted from the academic year 2020-23)

SEMESTER I

Course Category	Course Code	Course Name	L	T	P	C
DC	CSC 105	Introduction to Programming Using C	3	0	0	3
DC	CSC 105L	Introduction to Programming Using C Lab	0	0	3	2
FC	PSY 111	Psychology For Everyday Living	4	0	0	4
FC	EGL 100	Introduction to Communicative English	4	0	0	4
DC	MAT 152	Single Variable Calculus	4	0	0	4
FC	ENV 100	Introduction to Environmental Science	4	0	0	4
		TOTAL	**19**	**0**	**3**	**21**

SEMESTER II

Course Category	Course Code	Course Name	L	T	P	C
DC (Honors)	CSC 102	Introduction to Programming Using Python	3	0	0	3
DC(Honors)	CSC 102L	Introduction to Programming Using Python Lab	0	0	3	2
DC	CSC 107	Data Structures	3	0	0	3
DC	CSC 107L	Data Structures Lab	0	0	3	2
DC	CSC 122	Computer Organization and Architecture	3	0	0	3
DC	CSC 122L	Computer Organization and Architecture Lab	0	0	3	2
FC	MAT 221	Probability and Statistics For Engineers	3	1	0	4
FC	EGL 125	Critical Thinking	4	0	0	4
FC	HIS 100	Idea of India	4	0	0	4
		TOTAL	**20**	**1**	**9**	**27**

SEMESTER III

Course Category	Course Code	Course Name	L	T	P	C
DC	CSC 203	Operating Systems	3	0	0	3
DC	CSC 203L	Operating Systems Lab	0	0	3	2
DC	CSC 201	Design and Analysis of Algorithms	3	0	0	3
DC	CSC 201L	Design and Analysis of Algorithms Lab	0	0	3	2
DC	CSC 206	Object oriented Programming With C++	3	0	0	3
DC	CSC 206L	Object oriented Programming With C++ Lab	0	0	2	1
ADC		CSC Allied subject – 1 (D1)	4	0	0	4
ADC		CSC Allied subject – 1 (D2)	4	0	0	4
DC	MAT 252	Discrete Mathematics	4	0	0	4
DC	CSC 220	Industrial Standard Coding Practice-1	0	0	4	1
		TOTAL	**21**	**0**	**12**	**27**

SEMESTER IV

Course Category	Course Code	Course Name	L	T	P	C
DC		CSC Elective 1	4	0	0	4
DC	CSC 207	Java Programming	3	0	0	3
DC	CSC 207 L	Java Programming Lab	0	0	3	2
ADC		CSC Allied subject – 2 (D1)	4	0	0	4
ADC		CSC Allied subject – 2 (D2)	4	0	0	4
DC (Honors)	CSC 413/ CSC 310	Artificial Intelligence/ Applied Data Science	3	0	0	3
DC (Honors)	CSC 413 L/ CSC 301L	Artificial Intelligence Lab/ Applied Data Science Lab	0	0	2	1
DC	CSC 230	Industrial Standard Coding Practice-2	0	0	4	1
		TOTAL	**18**	**0**	**9**	**26**

SEMESTER V

Course Category	Course Code	Course Name	L	T	P	C
DC	CSC 304	Database Management Systems	3	0	0	3
DC	CSC 304L	Database Management Systems Lab	0	0	3	2
DC		CSC Elective 2	4	0	0	4
DC		CSC Elective 3	4	0	0	4
DC (Honors)	CSC 336/ CSC 338	Machine Learning/ Data Warehousing and Mining	3	0	0	3
DC (Honors)	CSC 336L/ CSC 338L	Machine Learning Lab/ Data Warehousing and Mining Lab	0	0	2	1

DC (Honors)	CSC 314/ CSC 417	Digital Image Processing/Principles of Big data Management	3	0	0	3
DC (Honors)	CSC 314L/ CSC 417L	Digital Image Processing Lab/Principles of data Management Lab	0	0	2	1
OE	OE	Open Elective 1	4	0	0	3/4
DC	CSC 240 (DC)	Industrial Standard Coding Practice-3	0	0	4	1
		TOTAL	**21**	**0**	**11**	**24/25**

SEMESTER VI

Course Category	Course Code	Course Name	L	T	P	C
OE		Open Elective 2	4	0	0	3/4
DC (Honors)	CSC412/ CSC 419	Principles of Soft Computing/Information Retrieval	3	0	0	3
DC (Honors)	CSC412L/ 419 L	Principles of Soft Computing Lab/Information Retrieval Lab	0	0	2	1
DC		CSE Elective 4	4	0	0	4
DC		CSE Elective 5	4	0	0	4
DC	CSC 340	Project	0	0	8	4
		TOTAL	**15**	**0**	**10**	**19/20**

Total Credits: 21 + 27 + 27 + 22 + 24/25 + 19/20 = 140/142 credits

Honours in AI & ML

Students who would like to take Honours in AI and ML are recommended to take four domains specific specializations

Course Code	Course Name	L	T	P	C
CSC 102	Introduction to Programming Using Python	3	0	0	3
CSC 102L	Introduction to Programming Using Python Lab	0	0	3	2
CSC 413	Artificial Intelligence	3	0	0	3
CSC 413 L	Artificial Intelligence Lab	0	0	2	1
CSC 336	Machine Learning	3	0	0	3
CSC 336L	Machine Learning Lab	0	0	2	1
CSC 314	Digital Image Processing	3	0	0	3
CSC 314L	Digital Image Processing Lab	0	0	2	1
CSC412	Principles of Soft Computing	3	0	0	3
CSC412 L	Principles of Soft Computing Lab	0	0	2	1

Honours in Data Science

Students who would like to take Honours in Data Science are recommended to take four domain specific specializations

Course Code	Course Name	L	T	P	C
CSC 102	Introduction to Programming Using Python	3	0	0	3
CSC 102L	Introduction to Programming Using Python Lab	0	0	3	2
CSC 310L	Data warehousing and Mining	3	0	0	3
CSC 301L	Data warehousing and Mining Lab	0	0	2	1
CSC 338	Applied Data Science	3	0	0	3
CSC 338L	Applied Data Science Lab	0	0	2	1
CSC 417	Principles of Big data Management	3	0	0	3
CSC 417L	Principles of Big data Management Lab	0	0	2	1
CSC 419	Information Retrieval	3	0	0	3
CSC 419 L	Information Retrieval Lab	0	0	2	1

List of Electives

Students who would like to take specializations are recommended to take two general electives and four domain specific specializations.

Students who would like to pursue elective in general discipline can take any of the electives listed below provided offered in the particular semester.

Computer Science General Electives

Course Code	Course Name	L	T	P	C
CSC 320	Web Programming	3	0	0	3
CSC 321	Human Computer Interaction	3	0	0	3
CSC 322	Advanced Computer Architecture	3	0	0	3
CSC 323	Natural Language Processing	3	0	0	3
CSC 324	Computer Graphics	3	0	0	3
CSC 325	Advanced Data Structures and Algorithms	3	0	0	3
CSC 326	Distributed Operating Systems	3	0	0	3
CSC 420	Data and Web Mining	3	0	0	3
CSC 421	Complexity Theory	3	0	0	3
CSC 422	Software Project Management	3	0	0	3
CSC 423	Multimedia	3	0	0	3
CSC 424	Deep learning	3	0	0	3
CSC 425	Advanced Database Management Systems	3	0	0	3
CSC 426	Fog Computing	3	0	0	3
CSC 427	Parallel Algorithms	3	0	0	3

CSE 428	Web Services	3	0	0	3
CSC 429	Advances in Data Mining	3	0	0	3
CSC 303	Computer Networks	3	0	0	3
CSC 303 L	Computer Networks Lab	0	0	2	1
CSC 305	Software Engineering	3	0	0	3
CSC 305 L	Software Engineering-Lab	0	0	2	1
CSC 337	Cryptography	3	0	0	3
CSC 337 L	Cryptography Lab	0	0	2	1
CSC 315	Network Security	3	0	0	3
CSC 315 L	Network Security Lab	0	0	2	1
CSC 316	Distributed Systems	3	0	0	3
CSC 316 L	Distributed Systems Lab	0	0	2	1
CSC 318	Cloud Computing	3	0	0	3
CSC 318 L	Cloud Computing Lab	0	0	2	1
CSC 317	Embedded Systems	3	0	0	3
CSC 317 L	Embedded Systems Lab	0	0	2	1
CSC 424	Deep Learning	3	0	0	3
CSC 420	Data and Web Mining	3	0	0	3
CSC 323	Natural Language Processing	3	0	0	3

List of Allied Subjects

Students who would like to pursue two allied subject from two different departments other than CSE and this allied subjects listed below provided offered in the particular semester.

Other Department Allied Subjects

Department Mathematics

Course Code	Course Name	L	T	P	C
MAT 142	Single variable calculus	4	0	0	4
MAT 124	Multivariable Calculus	4	0	0	4
MAT 302	Numerical Analysis	4	0	0	4
MAT 303	Number Theory	4	0	0	4
MAT 154	Differential Equations	4	0	0	4
MAT 151	Linear Algebra	4	0	0	4

Department Physics

Course Code	Course Name	L	T	P	C
PHY 204	Physics I	3	0	0	3
PHY 204L	Physics II Lab	0	0	2	1
PHY 214	Physics II	3	0	0	3
PHY 214L	Physics II Lab	0	0	2	1

Department Management

Course Code	Course Name	L	T	P	C
BBA 304	Human Resource Management	4	0	0	4
BBA H01	Leadership and Team Management	4	0	0	4

Department History

Course Code	Course Name	L	T	P	C
HIS 102 A	Human Civilizations	4	0	0	4
HIS 301	European Social Formations	4	0	0	4

List of Foundation Courses

Course Category	Course Code	Course Name	L	T	P	C
FC	PSY 111	Psychology For Everyday Living	4	0	0	4
FC	EGL 100	Introduction to Communicative English	4	0	0	4
FC	ENV 100	Introduction to Environmental Science	4	0	0	4
FC	MAT 221	Probability And Statistics	3	1	0	4
FC	EGL 125	Critical Thinking	4	0	0	4
FC	HIS 100	Idea of India	4	0	0	4
FC	ENL 102	Why Read a Book	4	0	0	4
FC	DS 101	Foundations of Data Science	**2**	**2**	**0**	**4**

SEMESTER -I

SEMESTER-I

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 105	Introduction to Programming Using C	DC	3	0	0	3

UNIT I: INTRODUCTION

Computer systems, hardware, and software. Problem solving: Algorithm / Pseudo code, flowchart, program development steps Computer languages: Machine, symbolic and high-level languages Creating and Running Programs: Writing, editing (any editor), compiling (gcc), linking, and executing in Linux environment Structure of a C program, identifiers Basic data types and sizes. Constants, Variables Arithmetic, relational and logical operators, increment and decrement operator's Conditional operator, assignment operator, expressions Type conversions, Conditional Expressions Precedence and order of evaluation, Sample Programs.

UNIT II

SELECTION & DECISION MAKING: if-else, null else, nested if, examples, Multi-way selection: switch, else-if, examples.

ITERATION: Loops - while, do-while and for, break, continue, initialization and updating, event and counter controlled loops and examples.

ARRAYS: Concepts, declaration, definition, storing and accessing elements, one dimensional, two dimensional and multidimensional arrays, array operations and examples. Character arrays and string manipulations.

UNIT III: MODULAR PROGRAMMING

Functions - Basics, parameter passing, storage classes extern, auto, register, static, scope rules, user defined functions, standard library functions, Passing 1-D arrays, 2-D arrays to functions. Recursive functions - Recursive solutions for fibonacci series, towers of hanoi. C Pre-processor and header files.

UNIT IV: POINTERS

Concepts, initialization of pointer variables, pointers as function arguments, passing by address, dangling memory, address arithmetic, character pointers and functions, pointers to pointers, pointers and multi-dimensional arrays, dynamic memory management functions, command line arguments.

UNIT V: ENUMERATED, STRUCTURE AND UNION TYPES

Structures - Declaration, definition, and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures. Unions, typedef, bit-fields, program applications. Bit-wise operators: logical, shift, rotation, masks.

FILE HANDLING: Concept of a file, text files and binary files, formatted I/O, file I/O operations and example programs.

TEXTBOOKS

1. The C programming Language by Brian Kernighan and Dennis Richie.

REFERENCES

1. Problem Solving and Program Design in C, Hanly, Koffman, 7th edition, PEARSON 2013.
2. Programming in C, Pradip Dey and Manas Ghosh, Second Edition, OXFORD Higher Education, 2011.
3. Programming in C, A practical approach Ajay Mittal PEARSON.
4. Programming in C, B. L. Juneja, Anith Seth, First Edition, Cengage Learning.

SEMESTER-I

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 105 L	Introduction to Programming Using C Lab	DC	0	0	3	2

LIST OR PRACTICAL EXPERIMENTS

Week-1: Basic C programs

a. Calculation of the area of triangle.
b. Swap two numbers without using a temporary variable.
c. Find the roots of a quadratic equation.
d. Takes two integer operands and one operator form the user, performs the operation and then prints the result.

1. **Week-2:** Loops
   a. Find the sum of individual digits of a positive integer and find the reverse of the given number.
   b. Generate the first n terms of Fibonacci sequence.
   c. Generate all the prime numbers between 1 and n, where n is a value supplied by the user.
   d. Print the multiplication table of a given number n up to a given value, where n is entered by the user.

2. **Week-3:** Loops
   a. Decimal number to binary conversion.
   b. Check whether the given number is Armstrong number or not.
   c. Triangle star patterns

I II III

3. **Week-4:** Arrays
   a. Interchange the largest and smallest numbers in the array.
   b. Searching an element in an array
   c. Sorting array elements.

4. **Week-5:** Matrix
   a. Transpose of a matrix.
   b. Addition and multiplication of 2 matrices.

5. **Week-6:** Functions

a. (nCr) and (nPr) of the given numbers
b. $1+x+x^2\backslash 2+x^3\backslash 3!+x^4\backslash 4!+\ldots\ldots\ldots..X^n\backslash n!$

6. **Week-7:** Functions and array
   a. Function to find both the largest and smallest number of an array of integers.
   b. Liner search.
   c. Replace a character of string either from beginning or ending or at a specified location.

7. **Week-8**: Pre-processor directives
   a. If Def
   b. Undef
   c. Pragma

8. **Week-9:** Structures
   a. Reading a complex number
   b. Writing a complex number.
   c. Addition of two complex numbers
   d. Multiplication of two complex numbers

9. **Week-10:** String operations without using the built-in functions
   a. Concatenate two strings
   b. Append a string to another string.
   c. Compare two strings
   d. Length of a string
   e. Find whether a given string is palindrome or not

10. **Week-11:** Pointers
    a. Illustrate call by value and call by reference.
    b. Reverse a string using pointers
    c. Compare two arrays using pointers

11. **Week-12:** Pointers and array
    a. Array of Int and Char Pointers.
    b. Array with Malloc(), calloc() and realloc().

12. **Week-13:** Recursion
    a. To find the factorial of a given integer.
    b. To find the GCD (greatest common divisor) of two given integers.
    c. Towers of Hanoi

13. **Week-14:** File Operations
    a. File copy
    b. Word, line and character count in a file.

14. **Week-15:** Command line arguments
    a. Merge two files using command line arguments.

SEMESTER-I

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
PSY 111	Psychology for Everyday Living	FC	4	0	0	4

UNIT I: MYTHS AND MISCONCEPTIONS IN PSYCHOLOGY

Definition, nature and goals of psychology, Common myths and misconceptions about psychology Schools of psychology; Basic and applied areas of psychology

UNIT II: THE ROLE OF PERCEPTION AND ATTITUDE TOWARDS UNDERSTANDING THE WORLD

Perception: Understanding perception, Gestalt laws of organization, common illusions, Perceptual constancy - depth perception, size perception, perception of movement, Attitude formation, Attitude change

UNIT III: INTELLIGENCE AND LEARNING

Definitions and nature of intelligence, Emotional and social intelligence; Measuring IQ, EQ and SQ, Fundamentals of learning and its applications, Memory techniques.

UNIT IV: UNDERSTANDING THE SELF

Definition; Approaches to personality – trait and type, Psychoanalytical and humanistic theory, Tests of personality – MBTI and NEO-PI, Identity; Self-concept, self-esteem and self-efficacy.

UNIT V: STRESS, COPING AND QUALITY OF LIFE

Nature, sources of stress and its reactions, Factors influencing stress, coping with and managing stress - cognitive and behavioural techniques, Improving quality of life.

TEXTBOOKS

1. Baron, R. A. (2001). Psychology. New Delhi: Pearson Education India.

REFERENCES

1. Nolen-Hoeksema, S., Fredrickson, B.L. & Loftus, G.R. (2014). Atkinson & Hilgard's Introduction to Psychology.16th Ed. United Kingdom: Cengage Learning.
2. Nolen-Hoeksema, S., Fredrickson, B.L. & Loftus, G.R. (2014). Atkinson & Hilgard's Introduction to Psychology.16th Ed. United Kingdom: Cengage Learning.

SEMESTER-I

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
EGL 100	Introduction to Communicative English	FC	4	0	0	4

UNIT I
Course Introduction and Overview, Tenses, Principles of Sentence Structure& Paragraph Writing(*S+V+O*)

UNIT II
The Fundamentals of Speech (*Ethos, Pathos & Logos*) Verbal & Nonverbal Communication, Fundamentals of Personal, Informative, and Scientific Speech.

UNIT III
Listening Skills: Definition, Barriers, steps to Overcome. Listening to Influence, Negotiate, Note taking & Making while Listening.

UNIT IV
Read to Skim, and Scan, Read to Comprehend (Predict, Answer Questions & Summarize). Read to Understand.

UNIT V
Write to Inform - I News, Emails. Write to Inform- II Notice, Agenda & Minutes. Write to Define (Definitions & Essays).

TEXTBOOKS/REFERENCES

1. Shoba, Lourdes. (2017). Communicative English: A Workbook. U.K: Cambridge University Press.
2. Steven, Susan, Diana. (2015). Communication: Principles for a Lifetime. U.S.A: Pearson 6th Ed.
3. Publication Manual of the American Psychological Association, (2010). 6th Ed.
4. Kosslyn, S.M. "Understanding Charts and Graphs", Applied Cognitive Psychology, vol. 3, pp. 185-226, 1989.

SEMESTER I

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
MAT 152	Single Variable Calculus	DC	4	0	0	4

UNIT I: DERIVTIVES AND DIFFERENTITATION

Limit, Continuity and limits of quotients, Derivatives and its geometrical Interpretation, Derivative as a function and calculating derivative, Leibnitz notation and higher derivatives, Trigonometric functions, Linear Approximations, Product and quotient rules, Chain rule, Implicit differentiation, Inverse, exponential and logarithm functions.

UNIT II: APPROXIMATIONS AND THEIR APPLICATIONS

Measurement error of linear approximation, Quadratic approximation, Newton's method, 1 and 2nd derivative test, Limits and asymptotic, Max min problems, Related application in real-life problems.

UNIT III: THE INTEGRAL AND INTEGRATION THEORY

Mean Value Theorem, Differentials and anti-derivatives, Differential equations, The definite integral, First and Second Fundamental Theorem of Calculus.

UNIT IV: DIFFERENT INTEGRATION TECHNIQUES AND APPLICATIONS OF CALCULUS

Areas and Volumes, Average value, Probability, Numerical Integration, Integrals of Trigonometric Power, Trigonometric substitution, Partial fractions, Integration by Parts, Arc length and Surface area.

UNIT V: POLAR CO-ORDINATE SYSTEMS AND INFINITE SERIES

Parametric curves, Polar co-ordinates, L'Hospital's rule, Improper Integrals, Infinite Series, Taylor's series.

TEXTBOOKS

1. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, Third edition, Wiley India, 2005.
2. S. R. Ghorpade and B. V. Limaye, An Introduction to Calculus and Real Analysis,
3. Michael Spivak, Calculus, Third Edition, Cambridge University, 2008.

REFERENCES

1. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 3rd Ed., Pearson Education India 9th Edition 1999.
2. P.M. Fitzpatrick, Advanced Calculus, 2nd Edition, AMS Indian Edition, 2010.

SEMESTER I

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
ENV 100	Introduction to Environmental Science	FC	4	0	0	4

UNIT I: INTRODUCTION TO ENVIRONMENTAL SCIENCE

Ecosystem structure and function, Ecological systems and major biomes, Water and nutrient cycles - Water cycle, phosphorous cycle, nitrogen cycle, Natural resources: renewable and non-renewable resources, forests, water, minerals, food and land; Energy sources, growing energy demands. Case study – Cape Town water crisis.

UNIT II: BIODIVERSITY AND ITS CONSERVATION

Biodiversity hotspots; Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; threats to biodiversity – habitat loss, poaching of wildlife; in-situ and ex-situ conservation. Case Study-The Last White Rhino, GMO, animal testing.

UNIT III: ENVIRONMENTAL POLLUTION AND ITS ROLE ON GLOBAL CLIMATE CHANGE AND HUMAN HEALTH

Structure and composition of atmosphere. Pollution – air, water, soil, thermal and radiation. Effects – acid rain, ozone layer depletion and greenhouse gas emission, Carbon cycle, Control measures. Water and air quality – Dissolved Oxygen, Biochemical Oxygen Demand (BOD), Air Quality Index (AQI). Air Pollution and Infant Mortality, Pollution case studies, Exxon Valdez Oil spill. Two field trips.

UNIT IV: ENVIRONMENTAL BIOTECHNOLOGY

Environmental microbiology; Biomarkers; Biosensors; Biofuels; Biotransformation; Bioremediation, factors affecting bioremediation; Molecular Ecology. One field trip.

UNIT V: ENVIRONMENTAL PROTECTION, SUSTAINABILITY, AND THE ROLE FOR POLICY

The tragedy of commons, Problems related to urban living, population explosion, waste management, sustainable solutions, role of regulation and taxes in environmental protection, the willingness to pay for clean air, environmental movements, and environmental protection acts in India and environmental ethics. Case study- Chinese Environmental Protection Tax, Water resource tax, CNG vehicles in Delhi/Delhi odd-or-even rule. Two field trips.

TEXTBOOKS

1. Basu. M, Xavier. S. “Fundamentals of Environmental Studies”, 1st edition, Cambridge University Press, 2016.

2. Raina. M. Maier, Ian L. Pepper, Charles. P. “Environmental Microbiology” 2nd edition, Academic Press, 2004.

REFERENCES

1. Danial. D. C. “Environmental Science*”,* 8^{th} edition, Jones and Barlett Publishers, MA, 2010.

SEMESTER -II

SEMESTER-II

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 102	Introduction to Programming Using Python	DC	3	0	0	3

UNIT I: INTRODUCTION TO PYTHON

Knowledge, Machines, Languages, Types, Variables Operators and Branching -– Core elements of programs: Bindings, Strings, Input/Output, IDEs, Control Flow, Iteration, Guess and Check – Simple Programs: Approximate Solutions, Bisection Search, Floats and Fractions, Newton-Raphson.

UNIT II: FUNCTIONS

Decomposition and Abstraction, Functions and Scope, Keyword Arguments, Specifications, Iteration vs Recursion, Inductive Reasoning, Towers of Hanoi, Fibonacci, Recursion on non-numeric, Files.

UNIT III: TUPLES AND LISTS

Tuples, Lists, List Operations, Mutation, Aliasing, Cloning – Dictionaries: Functions as Objects, Dictionaries, Example with a Dictionary, Fibonacci and Dictionaries, Global Variables – Debugging: Programming Challenges, Classes of Tests, Bugs, Debugging, Debugging Examples– Assertions and Exceptions, Assertions, Exceptions, Exception Examples.

UNIT IV: CLASSES AND INHERITANCE

Object Oriented Programming, Class Instances, Methods Classes Examples, Why OOP, Hierarchies, Your Own Types – An Extended Example: Building a Class, Visualizing the Hierarchy, adding another Class, Using Inherited Methods, Gradebook Example, Generators.

UNIT V: COMPUTATIONAL COMPLEXITY

Program Efficiency, Big Oh Notation, Complexity Classes Analyzing Complexity – Searching and Sorting Algorithms: Indirection, Linear Search, Bisection Search, Bogo and Bubble Sort, Selection Sort, Merge Sort.

TEXTBOOKS

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT).

REFERENCES

1. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10June2017), ISBN-10: 0199480173.
2. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016).
3. Fundamentals of Python first Programmes by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1stedition (6th February 2009).

SEMESTER II

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 102 L	Introduction to Programming Using Python Lab	DC	0	0	3	2

LIST OF PRACTICAL EXPERIMENTS

1. A company decided to give bonus of 5% to employee if his/her year of service is more than 5 years. Ask user for their salary and year of service and print the net bonus amount.
2. Write a program that computes the real roots of a quadratic function. Your program should begin by prompting the user for the values of a, b and c. Then it should display a message indicating the nature of real roots, along with the values of the real roots (if any).
3. Write a Python program to find the factorial of the given number (Example: 5! = 5*4*3*2*1 =120).
4. Write a Python program to read the numbers from the keyboard using a loop, perform the sum and average of all the input numbers until "-10" is encountered.
5. Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.
6. Write a python program for bubble sort algorithm. What is the best case and worst-case time complexity of Bubble sort algorithm? Explain with an example, where the list of elements is not sorted then what would be the output after each iteration/pass.
7. Write a python program for Selection sort algorithm. What is the worst case or average case time complexity of selection sort algorithm?
8. Write a Program in python using object-oriented concept to make calculator which has the following operations: Addition, Subtraction, Multiplications, Divisions, Exponentials, Modulus.
9. Define is inheritance? Explain with suitable example: Single level inheritance, Multiple Inheritance, Multi-level Inheritance.
10. Write a Program in python using object-oriented concept to create a base class called Polygon and there are three derived classes named as triangle, rectangle and square. The base class consists of the input function for accepting sides length and the derived classes must have output function for displaying area of triangle, rectangle and square.

TEXTBOOKS

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT).
2. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017), ISBN-10: 0199480173.
3. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016).

SEMESTER-II

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 107	Data Structures	DC	3	0	0	3

UNIT I: INTRODUCTION TO C PROGRAMMING

Basic elements of C: identifiers, basic data types, constants, variables, keywords, operators: arithmetic, relational and logical, increment and decrement operators, conditional operator, assignment operators, Instruction: type declaration, Input-output, conditional, loop control, Arrays, Functions, pointers, dynamic memory management functions Derived types- structures- declaration, definition and initialization of structures, accessing member of structure, arrays of structures, structures and functions, pointers to structures, self-referential structures.

UNIT II: INTRODUCTION TO DATA STRUCTURES

Stacks and Queues: representation and application, implementation of stack and queue operations using C. Linked lists: Single linked lists, implementation of link list and various operation using C, Double linked list, circular list.

UNIT III: TREES

Tree terminology, Binary tree, Binary search tree, infix to post fix conversion, postfix expression evaluation. General tree, AVL Tree, Complete Binary Tree representation.

UNIT IV: GRAPHS

Graph terminology, Representation of graphs, Path matrix, BFS (breadth first search), DFS (depth first search), topological sorting, Shortest path algorithms.

UNIT V: SORTING AND SEARCHING TECHNIQUES

Bubble sort, selection sort, Insertion sort, Quick sort, merge sort, Heap sort, Radix sort, implementation using C. Linear and binary search methods, implementation using C, Hashing techniques and hash functions.

TEXTBOOKS

1. "Data structure using C", Aaron M. Tenenbaum, Y Langsam and Mosche J. Augenstein, Pearson publication.
2. Data structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson publications, Second Edition Programming in C. P. Dey and M Ghosh, Second Edition, Oxford University Press.
3. Programming with C, Byron Gottfried, McGraw hill Education, Fourteenth reprint, 2016.

REFERENCES

1. "Fundamentals of data structure in C" Horowitz, Sahani & Anderson Freed, Computer Science Press.
2. "Fundamental of Data Structures", (Schaums Series) Tata-McGraw-Hill.
3. G. A. V. Pai: "Data Structures & Algorithms; Concepts, Techniques & Algorithms" Tata McGraw Hill.

SEMESTER-II

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 107 L	Data Structures Lab	DC	0	0	3	2

LIST OF PRACTICAL EXPERIMENTS

1. Write a C program to find the factorial of the given number (Example: 5! = 5*4*3*2*1 =120).
2. Write a C program to read the numbers from the keyboard using a loop, perform the sum and average of all the input numbers until "-10" is encountered.
3. Write a C program for implementation of Stack operations using arrays.
4. Write a C program for implementation of Queue operations using arrays.
5. Write a C program for Linked list implementations and problems related to linked list such as inverting list, concatenation, etc.
6. Write a C program for Linked list-based implementation of stack and queue operations.
7. Write a C program for Evaluation of expressions.
8. Write a C program for implementation of Binary tree traversals techniques.
9. Write a C program for implementation of Graph traversals techniques (BFS and DFS).
10. Write a C program for Linear search and Binary search algorithms. What is the best case and worst-case time complexity of those searching algorithms?
11. Write a C program for bubble sort algorithm. What is the best case and worst-case time complexity of Bubble sort algorithm?
12. Write a C program for Selection sort algorithm. What is the worst case or average case time complexity of selection sort algorithm?
13. Write a C program for Insertion sort algorithm. What is the worst case or average case time complexity of Insertion sort algorithm?
14. Write a C program for Quick sort algorithm. What is the worst case or average case time complexity of Quick sort algorithm?
15. Write a C program for Merge sort algorithm. What is the worst case or average case time complexity of Merge sort algorithm?

SEMESTER-II

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 122	Computer Organization and Architecture	DC	3	0	0	3

UNIT I: BASIC STRUCTURE OF COMPUTERS

Functional units – Bus structures – Instruction set architecture: Instruction formats - addressing modes - Architecture and instruction set of 8086/8088 microprocessor- Assembly language programming - Fixed point and floating-point operations – ALU design.

UNIT II: BASIC PROCESSING UNIT

Fundamental concepts – Execution of a complete instruction – Hardwired control – Micro programmed control design- Nano programming- CISC-RISC- principles.

UNIT III: PIPELINE PROCESSING

Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Pipeline optimization techniques: Compiler techniques for improving performance.

UNIT IV: MEMORY SYSTEM

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance – Virtual memory – Memory management requirements– Associative Memories-Secondary-storage-devices.

UNIT V: I/O ORGANIZATION

Accessing I/O devices – Programmed Input/output - Interrupts – Direct Memory Access– Interface circuits – Standard I/O Interfaces - I/ O devices and Processors.

TEXTBOOKS

1. Computer System Architecture, Morris Mano, Third edition, Pearson publications.
2. Computer Organization, Carl Hamacher, Zvonko Vranesic and Safwat Zaky, V Edition, McGraw-Hill publications.
3. "Computer Organization and Architecture – Designing for Performance", William Stallings, Ninth edition, Pearson publications.

REFERENCES

1. Andrew S. Tanenbaum, "Structured Computer Organization".
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface".
3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill.
4. An Introduction to 8086/8088 Assembly Language Programming, Thomas P. Skinner, John Wiley & Sons, 1985.

SEMESTER-II

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC122 L	Computer Organization and Architecture Lab	DC	0	0	3	2

LIST OF PRACTICAL EXPERIMENTS

1. Assembly language programming.
2. Development of simulator for a hypothetical CPU.
3. Development of Assembler for hypothetical CPU.
4. Design of Hardwired control unit for a hypothetical CPU.
5. Design of Microprogrammed control unit for a hypothetical CPU.

SEMESTER-II

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
MAT 221	Probability and Statistics for Engineers	FC	3	1	0	4

UNIT I: INTRODUCTION TO PROBABILITY

Introduction, counting and set, terminologies and examples, conditional probability, independence and Bayes' theorem.

UNIT II: PARTIAL DERIVATIVES

Discrete random variables, variance of discrete random variables, continuous random variables, Expectation, variance and standard deviation of continuous random variables, central limit theorem and law of large numbers, joint distributions and independence, covariance and correlation.

UNIT III: BAYESIAN INFERENCE

Introduction to statistics, Maximum likelihood estimate, Bayesian updating: discrete priors, probabilistic prediction, odds, continuous priors; Beta distribution, conjugate priors, probability intervals.

UNIT IV: NULL HYPOTHESIS SIGNIFICANCE TESTING

The frequentist school of statistics, Null hypothesis significant testing, comparison between frequentist and Bayesian inference

UNIT V: CONFIDENCE INTERVALS AND REGRESSIONS

Confidence intervals: normal data, three views, mean of the non-normal data; Bootstrap confidence intervals, linear regression.

TEXTBOOKS

1. J. Jacod and P. Protter, Probability Essentials, Springer, 2004.
2. K. S. Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications, Wiley India, 2008.

REFERENCES

1. S. Ross, A First Course in Probability, 6th Edn., Pearson, 2002.

SEMESTER-II

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
EGL 125	Critical Thinking	FC	4	0	0	4

UNIT I
Analyzing Problems, Science of Learning, Logical Thinking

UNIT II
Analyzing Decisions, Applying logic

UNIT III
Evaluating Claims and Justifications, Fallacy Detection, Understanding Bias, Mitigating Bias

UNIT IV
Evaluate and Use Strategies, Identifying the Right Problem and Sub problems, Gaps and Constraints

UNIT V
Solving Problems, Using Analogies in Problem Solving, Innovative Thinking

SEMESTER-II

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
HIS 100	Idea of India	FC	4	0	0	4

UNIT I: THE NATION AND ITS MANY ROOTS

What is a Nation? –Theories of Nationalism, The many names of India: India, Hindia, Aryavarta Or Bharat, Mother India: Iconising a Nation

UNIT II: UNEARTHING THE PAST

The Evolutionary Past: Interbreeding Vs Replacement Theory, Out of Africa Theory, What is a civilization? Theories of Civilization, Indus Valley Civilization

UNIT III: STORIES OF GODS AND PEOPLE

The Emergence of Myths, Myth Vs Reality, Vedic Age in India, Tribes, Caste and Battles.

UNIT IV: POLITY AND GOVERNANCE

Religion, Economy and the State –Asoka, Chankya and the Buddha, Land the Economy: Exploring the Arthasastra, Social Order and the State: Through the Epics, Two millennia of pluralism: Jews, Christians and other religions in India.

UNIT V: TOWARDS UNDERSTANDING THE NATION

The Mughals in India, Multiple Identities – the same heritage, The Past as a Signifier

TEXTBOOKS

1. Y. N.Harari, A Brief History of Humankind, Harper, 2015.
2. Upinder Singh, A History of Ancient and Early Medieval India, Pearson, 2009.
3. Romila Thapar, Early India: From the Origins to AD 1300, University of California Press, 2004.

SEMESTER -III

SEMESTER-III

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 203	Operating Systems	DC	3	0	0	3

UNIT I: INTRODUCTION TO OPERATING SYSTEM

What is an Operating System? Simple Batch Systems, Multiprogramming and Time-Sharing systems. Personal Computer Systems, Parallel Systems, Distributed Systems and Real Time Systems.

Operating System Structures: Operating System Services, System components, Protection system, Operating System Services, system calls.

UNIT II: PROCESS MANAGEMENT

Process Concept, Process Scheduling, Operation on Processes, inter process communication, Examples of IPC Systems, Multithreading Models, Threading Issues, Process Scheduling Basic concepts, scheduling criteria, scheduling algorithms, Thread Scheduling.

UNIT III: PROCESS COORDINATION

Synchronization: The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors.

Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock.

UNIT IV: MEMORY MANAGEMENT

Memory Management strategies, Logical versus Physical Address space, swapping, contiguous Allocation, Paging, Segmentation. Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, Page Replacement Algorithms. Allocation of frames, Thrashing, Demand Segmentation.

UNIT V: STORAGE MANAGEMENT

File System Concept, Access Methods, File System Structure, File System Structure, File System Implementation, Directory implementation, Efficiency and Performance, Recovery, Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, I/O System Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Request to Hardware Operation.

TEXTBOOKS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc.
2. Operating System, Harvey M. Dietel, Paul J. Deitel and David R. Choffnes, Pearson Publications, Third Edition.
3. William Stallings, "Operating Systems – Internals and Design Principles", 9th Edition, Pearson publications.
4. Andrew S. Tanenbaum, "Modern Operating Systems", Fourth Edition, Pearson publications.
5. Mastering Unix Shell scripting, Randal K. Michael, Wiley Publications, Second Edition.

6. Linux system programming, Robert Love, O'Reily Publications, First Edition, 2007.

SEMESTER-III

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 203 L	Operating Systems Lab	DC	0	0	3	2

LIST OF PRACTICAL EXPERIMENTS

1. Shell Programming exercises.
2. Implementing Linux system commands using system calls.
3. CPU Scheduling Algorithms.
4. Computing page faults for various page replacement algorithms.
5. Simulation of Demand Paging System.
6. Implement producer, consumer problem using semaphores.
7. Implement deadlock avoidance and detections algorithms.
8. Project Development.

SEMESTER-III

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 201	Design and Analysis of Algorithms	DC	3	0	0	3

UNIT I: INTRODUCTION
Algorithmic thinking & motivation with examples, Reinforcing the concepts of Data Structures with examples. Complexity analysis of algorithms: big O, omega, and theta notation, Analysis of Sorting and Searching, Hash table, Recursive and non-recursive algorithms.

UNIT II: GENERAL PROBLEM SOLVING (GPS) TECHNIQUES
Divide and conquer: Merge sort, Quicksort, BST, Master method for Complexity analysis
Greedy method: Fractional Knapsack, Minimum spanning trees (Prim's & Kruskal's), Shortest paths: Dijkstra's algorithm, Huffman coding Dynamic Programming: 0/1 Knapsack, All-to-all shortest paths.

UNIT III
BFS & DFS, Backtracking: 8-Queens problem, Knights tour, Travelling Salesman Problem (TSP), Branch-and-bound: 16-puzzle problem, TSSP, Randomized algorithms: Playing Cards, Scheduling algorithms.

UNIT IV
Pattern matching algorithms: Brute-force, Boyer Moore, KMP algorithms. Algorithm analysis: Probabilistic Analysis, Amortized analysis, Competitive analysis.

UNIT V
Non-polynomial complexity: examples and analysis, Vertex cover, set cover, TSP, 3-SAT Approximation Algorithms: Vertex cover, TSP, Set cover.

TEXTBOOKS

1. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", 3rd Edition, MIT press, 2009.
2. Parag Dave & Himanshu Dave, "Design and Analysis of Algorithms", Pearson Education, 2008.

REFERENCES

1. Michel Goodrich, Roberto Tamassia, "Algorithm design-foundation, analysis & internet examples", Wiley., 2006.
2. A V Aho, J E Hopcroft, J D Ullman, "Design and Analysis of Algorithms", Addison-Wesley Publishing.
3. Algorithm Design, by J. Kleinberg and E. Tardos, Addison-Wesley, 2005.
4. Algorithms, by S. Dasgupta, C. Papadimitriou, and U. Vazirani, McGraw-Hill, 2006.

SEMESTER-III

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 201 L	Design and Analysis of Algorithms Lab	DC	0	0	3	2

LIST OF PRACTICAL EXPERIMENTS

1. Selection sort, Insertion sort, Heap sort.
2. Creating singly linked list + Hash table as a set of linked lists.
3. Towers of Hanoi (Recursive& Non-recursive).
4. Merge sort.
5. Quicksort.
6. Fractional Knapsack.
7. Minimum-spanning tree.
8. One-to all shortest paths.
9. All-to-all shortest paths.
10. 0/1 knapsack.
11. Transitive closure/ Reachability problem.
12. Eight queens' problem.
13. 16-puzzle.
14. TSP approximation algorithm.
15. Vertex cover: Approximate algorithm.

SEMESTER-III

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 206	Object Oriented Programming using C++	DC	3	0	0	3

UNIT I: INTRODUCTION

What is object-oriented programming? Comparison of procedural programming and Object-Oriented Programming - Characteristics of Object-Oriented Languages - C++ Programming Basics: Basic Program Construction - Data Types, Variables, Constants - Type Conversion, Operators, Library Functions - Loops and Decisions, Structures - Functions: Simple Functions, passing arguments, Returning values, Reference Arguments. - Recursion, Inline Functions, Default Arguments - Storage Classes - Arrays, Strings, Addresses, and pointers. Dynamic Memory management. Linked lists in C++.

UNIT II: FEATURES OF OBJECT-ORIENTED PROGRAMMING

Introduction to Classes and Objects, Making sense of core object concepts (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces). Constructors and its types, Destructors - Passing Objects as Function arguments and Returning Objects from Functions.

UNIT III: POLYMORPHISM

Concept of Polymorphism, Function overloading, examples and advantages of function overloading, pitfalls of function overloading, Operator overloading, Overloading unary operations. Overloading binary operators, pitfalls of operators overloading.

UNIT IV: INHERITANCE

Concept of inheritance. Derived class and based class. Derived class constructors, member function, inheritance in the English distance class, class hierarchies, inheritance and graphics shapes, public and private inheritance, aggregation: Classes within classes, inheritance, and program.

UNIT V: TEMPLATES AND EXCEPTIONS

Templates: Function templates, Class templates - Exceptions: Need of Exceptions, keywords, Simple and Multiple Exceptions - Re-throwing Exception and Exception Specifications, Custom Exception.

Standard Template Library: Containers, Algorithms, iterators - potential problems with STL - Algorithms: find (), count (), sort (), search (), merge () - Function Objects: for each (), transform () - Sequence Containers: vectors, Lists, Dequeues - Iterators and specialized.

TEXTBOOKS

1. C++ Primer, Stanley B. Lippman, Stanley Lippman and Barbara Moo, Addison-Wesley Professional, Fifth edition, 2012.
2. C++: The complete reference, Schildt, Herbert. McGraw-Hill/Osborne, Fourth edition, 2017.

REFERENCES

1. Thinking in C++, Bruce, Eckel, Pearson, Second edition, Volume 1, 2002.

2. Object-oriented programming in C++, Robert Lafore, Course Sams Publishing, Fourth edition, 2001.
3. Lischner, Ray. STL Pocket Reference: Containers, Iterators, and Algorithms. " O'Reilly Media, Inc.", 2003.

SEMESTER-III

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 206 L	Object Oriented Programming using C++ Lab	DC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

Week-1:

1. Takes two integer operands and one operator form the user, performs the operation and then prints the result.
2. Generate all the prime numbers between 1 and n, where n is a value supplied by the user.
3. Searching an element in an array.
4. To find the factorial of a given integer.

Week-2:

1. Write a program to demonstrate the Inline functions.
1. Programs to understand different function call mechanism.
   a. call by reference b. call by value
1. Programs to understand storage specifiers

Week-3:

1. Write a Program to design a class having static member function named showcount() which has the property of displaying the number of objects created of the class.
1. Write a Program using class to process Shopping List for a Departmental Store. The list include details such as the Code No and Price of each item and perform the operations like Adding, Deleting Items to the list and Printing the Total value of a Order.

Week-4:

1. Write a Program which creates & uses array of object of a class.(for eg. implementing the list of Managers of a Company having details such as Name, Age, etc..).
1. Write a Program to find Maximum out of Two Numbers using friend function. Note: Here one number is a member of one class and the other number is member of some other class.

Week-5:

1. Write a Program to swap private data members of classes named as class_1, class_2 using friend function.
1. Write a Program to design a class complex to represent complex numbers. The complex class should use an external function (use it as a friend function) to add two complex numbers. The function should return an object of type complex representing the sum of two complex numbers.

Week-6:

1. Write a Program using copy constructor to copy data of an object to another object.
1. Write a Program to allocate memory dynamically for an object of a given class using class's constructor.

Week-7:

1. Write a Program to design a class to represent a matrix. The class should have the functionality to insert and retrieve the elements of the matrix
1. Write a program to design a class representing complex numbers and having the functionality of performing addition & multiplication of two complex numbers using operator overloading.

Week-8:

1. Write a Program to overload operators like *, <<, >> using friend function. The following overloaded operators should work for a class vector.
1. Write a program for developing a matrix class which can handle integer matrices of different dimensions. Also overload the operator for addition, multiplication & comparison of matrices.

Week-9:

1. Write a program to overload new/delete operators in a class.
1. Write a program in C++ to highlight the difference between overloaded assignment operator and copy construct.

Week-10:

1. Write a Program illustrating how the constructors are implemented and the order in which they are called when the classes are inherited. Use three classes named alpha, beta, gamma such that alpha, beta are base class and gamma is derived class inheriting alpha & beta
1. Write a Program to design a student class representing student roll no. and a test class (derived class of student) representing the scores of the student in various subjects and sports class representing the score in sports. The sports and test class should be inherited by a result class having the functionality to add the scores and display the final result for a student.

Week-11:

1. Write a program to maintain the records of person with details (Name and Age) and find the eldest among them. The program must use this pointer to return the result.
1. Write a Program to illustrate the use of pointers to objects which are related by inheritance.

Week-12:

1. Write a program illustrating the use of virtual functions in class.
1. Write a program to design a class representing the information regarding digital library (books, tape: book & tape should be separate classes having the base class as media). The class should have the functionality for adding new item, issuing, deposit etc. the program should use the runtime polymorphism.

Week-13:

1. Write a program to show conversion from string to int and vice-versa.
1. Write a program showing data conversion between objects of different classes.

Week-14:

1. Write a program showing data conversion between objects of different classes and conversion routine should reside in destination class.
1. Write a program to copy the contents of one file to another.

Week-15:

1. Write a program to implement the exception handling.
1. Write a program to maintain the elementary database of employee using file concepts.

SEMESTER-III

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
MAT 252	Discrete Mathematics	DC	4	0	0	4

UNIT I

SETS, RELATIONS, AND FUNCTIONS

Set – Definition, Representation of a Set, Cardinality of a Set, Types of Sets, Venn Diagrams, Set Operations, Power Set, partitioning of a Set, Relations - Definition and Properties, Domain and Range, Representation of Relations using Graph, Types of Relations, Function – Definition, Injective / One-to-one function, Surjective / Onto function, Bijective / One-to-one Correspondent, Inverse of a Function, Composition of Functions.

UNIT II

MATHEMATICAL LOGIC

Propositional Logic, Prepositional Logic – Definition, Connectives, Tautologies, Contradictions, Contingency, Propositional Equivalences, Inverse, Converse, and Contra-positive, Duality Principle, Normal Forms, Predicate Logic, Predicate Logic – Definition Well Formed Formula, Quantifiers, Nested Quantifiers, Rules of Inference.

UNIT III

GROUP THEORY

Operators and Postulates, Closure, Associative Laws, Commutative Laws, Distributive Laws, Identity Element, Inverse, De Morgan’s Law, Group Theory, Semi group, Monoid, Group, Abelian Group, Cyclic Group and Subgroup, Partially Ordered Set (POSET), Hasse Diagram, Linearly Ordered Set, Lattice, Properties of Lattices, Dual of a Lattice.

UNIT IV

DISCRETE STRUCTURES

Graph and Graph Models - Types of Graphs, Representation of Graphs, Planar vs. Non-planar Graph, Isomorphism, Homomorphism, Euler Graphs, Hamiltonian Graphs, Graph Traversal,
Trees - Tree and its Properties, Centers and Bi-Centers of a Tree, Labelled Trees, Unlabeled trees, Rooted Tree, Binary Search Tree, Spanning Trees, Minimum Spanning Tree, Kruskal's Algorithm, Prim's Algorithm.

UNIT V

COUNTING & PROBABILITY

Counting Theory - The Rules of Sum and Product, Permutations, Combinations, Pascal's Identity, Pigeonhole Principle, The Inclusion-Exclusion principle, Discrete Mathematics, Probability- Basic Concepts, Probability Axioms, Properties of Probability, Conditional Probability, Bayes' Theorem.

TEXTBOOKS

1. Kresyig E., “Advanced Engineering Mathematics”, 5th Edition, John Wiley & Sons,
2. Babu Ram, “Engineering Mathematics”, Pearson Education.
3. Apostol Tom M, Calculus, Vol I and II John Wiley

REFERENCES

1. B.S. Grewal, “Elementary Engineering Mathematics”, 34th Ed.,
2. H.K. Dass, “Advanced Engineering Mathematics”, S. Chand & Company, 9th Revised Edition
3. Shanti Narayan, “Differential Calculas”, S.Chand& Company.

SEMESTER-III

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 220	Industrial Standard Coding Practice -1	DC	0	0	4	1

UNIT I
Problem Solving with - Basic coding practices, Expression Evaluation, Operators Usage, Expressions, Control Structures, Loop & Iterations for all test case scenarios.

UNIT II
Problem Solving using time efficient logics, linear list data, Array problems, 2D Arrays and Matrix Data for all test case scenarios.

UNIT III
Problem Solving with - Pointers & Memory referencing, String Handling, functions for all test case scenarios.

UNIT IV
Problem Solving with - parameter passing, Recursions, Recursion Analysis, Structures and unions, Enumerations & Memory allocation for all test case scenarios.

UNIT V
Problem solving with - String manipulations. Lists, display patterns, strings, matrix, tuples, dictionaries, modules, packages, exception handling using Python.

TEXTBOOKS

1. Problem solving with C++ -9e- Walter Savitch – Pearson.
2. The complete Reference C, Fourth REdition – Herbert Schildt – MC Graw Hill.
3. Programming in Python 3, A complete introduction to Python language - 2e - Mark Summerfield – Addison-Wiley.

SEMESTER -IV

SEMESTER-IV

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 207	Java Programming	DC	3	0	0	3

UNIT I: INTRODUCTION TO JAVA

An Overview of Java - Data types, Variables and Arrays, operators, expressions, Control statements, Classes, Objects, Constructor, Methods, this reference, static keyword, and final keyword; String handling, Compiling using command line argument; Inheritance - Concept, Member access, Abstract Class, Interface, Creating Multilevel hierarchy- super uses, Packages-access specifiers, using final with inheritance; Polymorphism - Compile time Polymorphism, Method overloading, Constructor overloading; Run time polymorphism, Method overriding, Dynamic method dispatch.

UNIT II: EXCEPTION HANDLING & MULTITHREADING

Fundamentals of exception handling, Uncaught exceptions, using try and catch, multiple catch blocks, Exception types - Introduction to Object class, Exception class hierarchy, Termination or presumptive models, Built-in exceptions, User defined exceptions, Nested try statements, Throw, Throws, and Finally. Multithreading- Differences between thread-based multitasking and process-based multitasking, Java thread model, Thread life cycle, Creating threads – Thread class, Runnable interface, Thread priorities, Synchronizing threads, Inter-thread communication.

UNIT III: STREAM BASED I/O (JAVA.IO)

Java API, The Stream Classes-Byte streams and Character streams, reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization, Enumerations, auto boxing, generics.

UNIT IV: THE COLLECTIONS FRAMEWORK (JAVA.UTIL) & JDBC

Collection's overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque, and other utility classes. Accessing a Collection via an Iterator, using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, String Tokenizer. JDBC – What is database, Table, SQL Syntax-Create, Insert, Select, Drop, Alter, Update, Delete, what is JDBC, JDBC Architecture and Components, JDBC Driver Types, Connections, Statements, Result Set.

UNIT V: GUI PROGRAMMING WITH SWING

Introduction - AWT & Swings, MVC architecture, components, containers. Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout. Event Handling- The Delegation event model- Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, Adapter classes, Inner classes, Anonymous Inner classes. A Simple Swing Application, Applets – Applets and HTML, Security Issues, Applets and Applications, passing parameters to applets. Creating a Swing Applet, painting in Swing, A Paint example, Exploring Swing Controls- J Label and Image Icon, J Text Field, The Swing Buttons- J Button, J Toggle Button, J Check Box, J Radio Button, J Tabbed Pane, J Scroll Pane, J List, J Combo Box, Swing Menus, Dialogs.

TEXTBOOKS

1. Java The complete reference, 11th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.

REFERENCES

1. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
2. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
3. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
4. Object Oriented Programming through Java, P. Radha Krishna, and Universities Press.
5. Programming in Java, S. Malhotra, S. Chaudhary, 2nd edition, Oxford Univ. Press.
6. Java Programming and Object-Oriented Application Development, R. A. Johnson, Cengage Learning.

SEMESTER-IV

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 207 L	Java Programming Lab	DC	0	0	3	2

LIST OF PRACTICAL EXPERIMENTS

1. Declare a class named Teacher. The class will have all the data members as per your convenient. The class will have constructors. Write a function to read the values of the class variables. The values of the variable will be stored in a FILE (text file). The values will be stored in a structured format of your own choice.
Further, read the content of the FILE and display the content in an ordered form (First Name, Last Name).

Concept Learning:
1. FILE manipulation
2. Use try catch blocks
3. Use multiple try catch block
4. Finally statement
Try to have your own Exception

2. Create three classes named Student, Teacher, Parents. Student and Teacher class inherits Thread class and Parent class implements Runnable interface. These three classes have run methods with statements. The task of the teacher class of the first assignment has to be synchronized. Similarly, the other two classes should have run methods with few valid statements under synchronized.

3. Create two classes named Student and Teacher with required data members. Assume that the information about the Student and Teacher is stored in a text file. Read n and m number of Student and Teacher information from the File. Store the information in Array list of type Student and Teacher Array List<Student> and Array List<Teacher>. Print the information of Teacher who taught OOPS and Maths. Use Iterator and other functions of util in your program.

4. Watch any of the favorite movie of your choice (any language is fine, preferably English). Create a Text file to store at least 10 meaningful dialogs from the movie and store it in a text file. Process the file to remove the stop words (eg. the, is, was, …….) and create another file to have clean text (word).

5. Write a java program to create Hashtable to act as a dictionary for the word collection. The dictionary meaning of the words, including synonyms, etc., has to be displayed.

6. Declare two classes Student and Teacher. The classes will have the data members and constructors as per your convenience. Write a JAVA program, (i) where the Teacher will enter the marks of the all the students in the database. (ii) Once the marks are entered, the student can view the marks.

7. Create GUI for the above program to upload the dialog FILE, clean the FILE. The GUI should take input from the user for invoking the dictionary for displaying dictionary meaning.

8. Declare a class named Teacher. The class will have all the data members as per your convenient. The class will have constructors. Develop a GUI to read the values of the class variables from the keyboard. Use text field to read the values. Use button to store it in a file one by one. The values will be stored in a structured format of your own choice.
Have an option in the GUI to search the name of the students by roll number and display the content in the test field.

9. Create two classes named Student and Teacher with required data members. Read the information about the student and teacher using text fields. Use checkbox to choose the option to feed either teacher information or student information. Store the information about the Student and Teacher in a text file. Read n and m number of Student and Teacher information from the File. Show in the GUI about a Teacher who taught two subjects to a section. Develop at least one of the applications (AWT problem) using swing package.

10. Create a Window based applications using various controls to handle subject registration for exams. Have a List Box to display the subject of semesters. Have one more List box having subject codes. Have a combo box to select the Semester, which will change the list of course and code in the list boxes. Display the subject registered for the examination on the right side of the window.

11. Declare a class named Teacher. The class will have all the data members as per your convenient. The class will have constructors. Develop a GUI to read the values of the class variables from the keyboard. Use text field to read the values. Use button to store it in a file one by one. The values will be stored in a structured format of your own choice.
Have an option in the GUI to search the name of the students by roll number and display the content in the test field. Develop at least one of the applications (AWT problem) using swing package.

12. Create a Window based application for displaying your photo album. Create a Frame and Canvas. Change the border, foreground and background colors of canvas and other controls. Have buttons to start the image show, pause the image show and end the image show. Explore the options to play background music.

13. Create a Window application with menu bar and menu. The frame will also have a text area with scroll bar. In the menu, have File related options. Open a file and its content has to be displayed in the text area.

14. Create a GUI using various controls: (i) to upload the marks of all the students presented in a marks.csv or marks.txt file into the database. (ii) to show the marks of the respective student after uploading the marks into the database. Note: Handle the exception, if the file is not present (or) if the marks are not uploaded in the database.

15. Individual Project. Every student should do a project to achieve all the course outcomes. Based on the course outcomes, the project will be evaluated.

SEMESTER-IV

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 413	Artificial Intelligence	E	3	0	0	3

UNIT I: INTRODUCTION
What is Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents.

UNIT II: SEARCH
Introduction to Search, Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, current-best-hypothesis search, least commitment search.

UNIT III: KNOWLEDGE REPRESENTATION AND REASONING
Inference, Propositional Logic, Predicate Logic (first order logic), Logical Reasoning, Forward &Backward Chaining, Resolution; AI languages and tools - Lisp, Prolog, CLIPS.

UNIT IV: PROBLEM SOLVING
Formulating problems, problem types, Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods.

UNIT V: LEARNING
Overview of different forms of learning, decision trees, rule-based learning, neural networks, reinforcement learning.
Game playing: Perfect decision game, imperfect decision game, evaluation function, minimax, alpha-beta pruning.

TEXTBOOKS

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education, Third Edition, Pearson Education, 2008.

REFERENCES

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill, 3rd edition, 2017.
2. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson.

SEMESTER-IV

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 413 L	Artificial Intelligence Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Week 1: Artificial Intelligence Problem identification and PEAS description.
2. Week 2: Introduction to AI programming Language PROLOG.
3. Week 3: Study of facts, objects, predicates and variables in PROLOG.
4. Week 4: Study of arithmetic operators, simple input/output and compound goals in PROLOG.
5. Week 5: Study of string operations in PROLOG. Implement string operations like substring,
6. string position, palindrome etc.
7. Week 6: Write a prolog program to implement all set operations (Union, intersection,
8. complement etc.
9. Week 7: Write a program for Usage of rules in Prolog.
   Create a family tree program to include following rules 1. M is the mother of P *if* she is a parent of P and is female 2. F is the father of P *if* he is a parent of P and is male 3. X is a sibling of Y *if* they both have the same parent. 4. Then add rules for grandparents, uncle-aunt, sister and brother. Based on the facts, define goals to answer questions related to
10. Week 8: Write programs for studying Usage of arithmetic operators in Prolog.
    Accept name of the student, roll no, his/her subject name, maximum marks and obtained marks in the subject. (Take marks of at least 6 subjects). Compute the percentage of a student. Display his result with other information.
    Accept department, designation, name, age, basic salary, house rent allowance (HRA) of an employee. Compute dearness allowance (DA) which is 15% of basic salary. Determine the gross salary (basic salary+HRA+DA) of the employee. Display all information of the employee (Generate Payslip).
11. Week 9: Implement a program for recursion and list in PROLOG.
12. Week 10: WAP for studying usage of compound object and list in Prolog.
    Write a program to maintain inventory items using a compound object:
    (i) Accept from user the details of at least 10 objects. (ii)Display from user the details of objects entered by user (2) Find and display odd and even numbers from a given input list.
13. Week 11: Write a prolog program to solve “Water Jug Problem”.
14. Week 12: Write a program to implement a monkey banana problem.
15. Week 13: Write a program to implement 8 Queens Problem.
16. Week 14: Write a program to solve traveling salesman problem.
17. Week 15: Write a program to solve water jug problem using LISP.

SEMESTER-IV

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 310	Data Warehousing and Mining	E	3	0	0	3

UNIT I

Data warehousing and Online Analytical Processing: Basic concepts of Data Warehouse – Data Warehouse Modelling – Data Warehouse Design and Usage – Data Warehouse Implementation – Data Generalization by Attribute-oriented Induction.

UNIT II

Data Mining: Knowledge Discovery from Data – Types of Data - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration – Data Reduction – Data Transformation and Data Discretization. Association Rule Mining – Frequent Itemset Mining methods – Pattern Evaluation Methods.

UNIT III

Classification – Basic Concepts – Decision Tree Induction – Bayes Classification Methods – Rule based Classification – Model Evaluation and Selection – Techniques to improve Classification Accuracy

UNIT IV

Clustering – Cluster Analysis – Partitioning Methods – Hierarchical Methods – Density-Based Methods – Grid Based Methods – Evaluation of Clustering.

UNIT V

Data Mining Trends and Research Frontiers - Mining Complex Data types – Other Methodologies of Data Mining – Data Mining Applications – Data Mining and Society – Data Mining trends.

TEXTBOOKS

1. Jiawei Han, Micheline Kamber and Jian Pei “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2011.

REFERENCES

1. G. K. Gupta “Introduction to Data Mining with Case Studies”, Third Edition, Prentice Hall of India, 2014.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar “Introduction to Data Mining”, Pearson Education, 2016.
3. K.P. Soman, Shyam Diwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
4. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.

SEMESTER-IV

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 310 L	Data Warehousing and Data Mining Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. **Week 1:** Implementation of OLAP operations.
2. **Week 2:** Data pre-processing techniques.
3. **Week 3:** Write a program in any programming language to generate at least 10,000 transactions in a text file with at least three items.
4. **Week 4 & 5:** Write a program to implement the APRIORI algorithm.
5. **Week 6 & 7:** Write a program for FP-Growth algorithm.
6. **Week 8 & 9:** Write a program to implement Decision tree-based classification.
7. **Week 10 & 11:** Write a program to implement Bayesian classification.
8. **Week 12:** Write a program to implement K-means clustering.
9. **Week 13:** Write a program to implement Divisive clustering.
10. **Week 14:** Write a program to implement Agglomerative clustering.
11. **Week 15:** Write a program to implement DBSCAN clustering.

TEXTBOOKS

1. Jiawei Han, Micheline Kamber and Jian Pei “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2011.

REFERENCES

1. G. K. Gupta “Introduction to Data Mining with Case Studies”, Third Edition, Prentice Hall of India, 2014.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar “Introduction to Data Mining”, Pearson Education, 2016.
3. K.P. Soman, Shyam Diwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
4. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.

SEMESTER-IV

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 230	Industrial Standard Coding Practice -2	DC	0	0	4	1

UNIT I
Problems Solving with: Structure Pointers, formation of links, Operations on Linked lists, Operations on a circular linked list, Operations on a double linked list & Industry Standard Practice Questions.

UNIT II
Problem Solving with - Stack Operations, Queue data structure Implementation, Linear / Binary Search Algorithms, Sorting Algorithms, Industry Standard Practice Questions.

UNIT III
Problem Solving with - Nonlinear data structures, trees operations, application of search property on a binary tree, tree balancing.

UNIT IV
Problem Solving with - Multiway search structures, Operations on a 2-4 tree, nonlinear structures,
red, black trees & operations, Tries, String Algorithms & Industry Standard Practice Questions.

UNIT V
Problem Solving with – features of Object-oriented programming, leveraging Standard Template Libraries. Industry Standards of leveraging DBMS concepts, SQL Queries, Entity Relationship Models, Query Optimization, Transactions & Concurrency, Normalization & Industry Standard Practice Questions.

TEXTBOOKS

1. Fundamentals of Data Structures in C++ - 2e- Sahni Horowitz - Universities Press.
2. Algorithms -4e- Robert Sedgewick & Kevin Wayne - Addison-Wesley Professional.
3. C++ Standard Library A Tutorial and Reference – 2e - Nicolai M. Josuttis - Addison Wesley Longman.
4. An Introduction to Database Systems – 8e - C.J. Date – Pearson.
5. Competitive Programming – 3e – Steven Halim, Felix Halim

SEMESTER -V

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 304	Database Management Systems	DC	3	0	0	3

UNIT I

Introductory concepts of DBMS: Introduction and applications of DBMS, Purpose of data base, Data, Independence, Database System architecture- levels, Mappings, Database, users and DBA, Relational Model: Structure of relational databases, Domains, Relations, Relational algebra – fundamental operators and syntax, relational algebra queries, tuple relational calculus

UNIT II

Entity-Relationship model: Basic concepts, Design process, constraints, Keys, Design issues, E-R diagrams, weak entity sets, extended E-R features – generalization, specialization, aggregation, reduction to E-R database schema

UNIT III

Relational Database design: Functional Dependency – definition, trivial and non-trivial FD, closure of FD set, closure of attributes, irreducible set of FD, Normalization – 1Nf, 2NF, 3NF, Decomposition using FD- dependency preservation, BCNF, Multi- valued dependency, 4NF, Join dependency and 5NF

UNIT IV

Transaction Management: Transaction concepts, properties of transactions, serializability of transactions, testing for serializability, System recovery, Two- Phase Commit protocol, Recovery and Atomicity, Log-based recovery, concurrent executions of transactions and related problems, Locking mechanism, solution to concurrency related problems, deadlock, , two-phase locking protocol, Isolation, Intent locking

UNIT V

SQL Concepts: Basics of SQL, DDL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions –numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. Transaction control commands – Commit, Rollback, save point

TEXTBOOKS

1. Fundamentals of Database Systems, Elmasri & Navathe, Addison Wesley, Sixth edition, 2011

REFERENCES

1. Elmasri & Navathe, “Fundamentals of Database Systems”, Addison Wesley.
2. Thomas Connolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation, and Management", Addison Wesley, Fourth Ed.
3. An Introduction to Database Systems, by C.J. Date, Addison-Wes.

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSE 304 L	Database Management System Lab	DC	0	0	3	2

LIST OF PRACTICAL EXPERIMENTS

Exercise-I

Create a data file to store records of the students (fields: rollno, name, branch,age). (ii) Sort the records of the file based on the rollno of the students. (iii) Perform external sorting procedure (based on the roll number) on two data files which store records of the students and store the result in to the third data file.

Exercise-II

Store student records (fields: rollno,name,branch,age) in a data file and perform linear search in the data file by reading *rollno* as input and then display the student details and display the time required to do this operation.

Exercise-III

Store student records (fields: rollno,name,branch,age) in a data file and build an index file by considering the *rollno* as the key.

i. Perform linear search in the index file by reading *rollno* as input and then display the student details by reading from the data file and display the time required to do this operation.

ii. Perform binary search in the index file (by sorting the index file based on the *rollno*) by reading *rollno* as input and then display the student details by reading from the data file and display the time required to do this operation.

Exercise-IV

Store student records (fields: rollno,name,branch,age) in a data file and build an index file by using binary search tree (*rollno* is used as the key).

i. Perform search in the index file by reading *rollno* as input and then display the student details by reading from the data file and display the time required to do this operation.

ii. Add and delete the student records from the data file and then perform corresponding modifications in the index file.

Exercise-V

Store student records (fields: rollno,name,branch,age) in a data file and build an index file by using hash table (*rollno* is used as the key here).

iii. Perform search in the index file by reading *rollno* as input and then display the student details by reading from the data file and display the time required to do this operation.

i. Add and delete the student records from the data file and then perform corresponding modifications in the index file.

Exercise-VI

Consider the following relations.

Suppliers (<u>sid:</u> integer, sname: string, address: string)

Parts (pid: integer, pname: string, color: string)
Catalog (sid: integer, pid: integer, cost: real)
The key fields are underlined, and the domain of each field is listed after the field name. Therefore, sid is the key for Suppliers, pid is the key for Parts, and sid and pid together form the key for Catalog. The Catalog relation lists the prices charged for parts supplied by Suppliers.

Write SQL statements for the following.

a. Find the names of suppliers who supply some **red color** part.
b. Find the sids of suppliers who supply some **red color** part and having office located at 'Chennai'
c. Find the average cost of **red color** parts supplied by various suppliers.
d. Find the names of the supplier who is supplying most number of parts.
e. Find the sids of suppliers who supply every part.
f. Find the sids of suppliers who supply every red color part.
g. List the number of suppliers for each color of part.
h. Find the supplier who supplies the **red color** part at a cheaper rate.
i. For each color part, display the details of the suppliers who supply that part at a cheaper rate.
j. Display the names of the suppliers along with the number of parts supplied by them.
k. Find the details of the supplier who supplies the costliest part.
l. Display the names of the suppliers who are selling at least two parts.

Exercise-VII

A) Consider the COMPANY database schema shown in the figure.

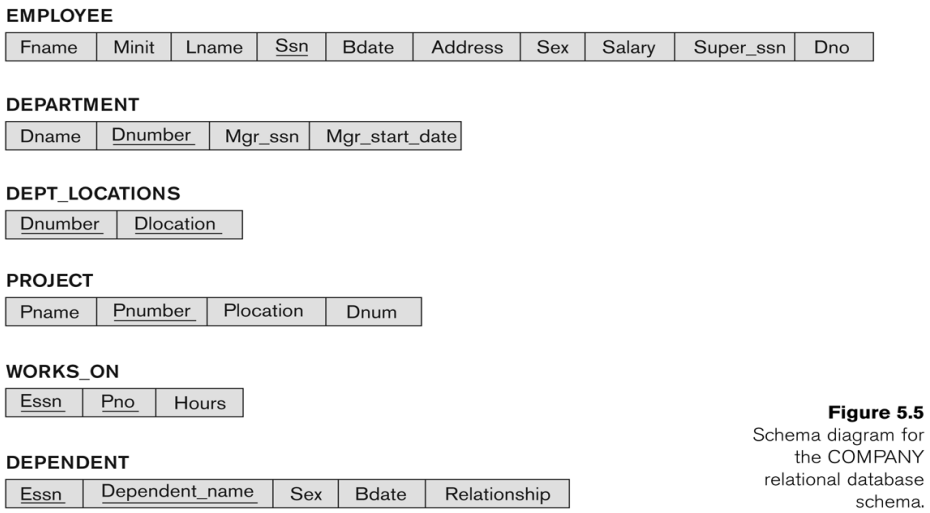

Figure 5.5
Schema diagram for the COMPANY relational database schema.

i. Create a view that has department name, manager name and manager salary for every department.
ii. Create a view that has project name, controlling depart name, number of employees, and total hours worked per week on the project for each project with more than one employee working on it.
iii. Create an updateable view for the relation DEPARTMENT

B) Create a materialized view for finding average salary of employees, average salary of managers, average salary for each department and department(s) which spend more money on salary for the employees.

C) Assume that Dno of EMPLOYEE relation has got NOT NULL constraint. Write a transaction which inserts tuples in to the relations EMPLOYEE and DEPARTMENT without affecting integrity constraints specified in the schema.

Exercise-VIII

A) Consider the following relations:
B) instructor(ID, name, dept_name, salary)

section(course_id, sec_ id, semester, year, building, room_ number, time_slot_id)
teaches(ID, course_id, sec_id, semester, year)

Write assertions for the following:

i. An instructor cannot teach in two different classrooms in a semester in the same slot
ii. An instructor cannot teach more than one course for the same semester

B) Consider the following relations.

product(maker, model, type)
pc(model, speed, ram, hd, price)
laptop(model, speed, ram, hd, screen , price)
printer(model, color, type, price)

Write triggers for the following:

(a) When updating the price of a PC, check that there is no lower priced PC with the same speed.
(b) When inserting a new printer, check that the model number exists in product.
(c) When making any modification to the Laptop relation, check that the average price of laptops for each manufacturer is at least Rs 1500.

C) Consider the following relations.

Emp (eno,ename,eage, salary,departno,supereno), dep(depno,depname,depage,eno), depart(departno,departname,location)

Write stored procedures

i. to find the average salary of employees who have got more than two dependents
ii. to find the names of employees (age is greater than 50) and their dependents (average age is less than 10).

Exercise-IX

Write java programs (using JDBC)

a. to create the following relations emp (eno,ename,eage, salary,departno,supereno), dep(depno,depname,depage,eno), depart(departno,departname,location) and insert at least 20 tuples for each relation.
b. (i) to find average age of employee's department wise (ii) to list department(s) (location wise) which pay less salary to the employees.

Exercise-X

Store student records (fields: rollno,name,branch,age) in a data file and build an index file by using B+ tree (rollno is used as the key here).

a. Perform search in the index file by reading roll no as input and then display the student details by reading from the data file and display the time required to do this operation.
b. Add and delete the student records from the data file and then perform corresponding modifications in the index file

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 336	Machine Learning	E	3	0	0	3

UNIT I

Introduction: Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance

Linear Regression: Introduction, Linear regression, Simple and Multiple Linear regression, Polynomial regression, evaluating regression fit.

UNIT II

Decision tree learning: Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, over fitting in decision tree and methods to avoid over fitting.

Instance based Learning: K nearest neighbour, theCurse of Dimensionality, Feature Selection: univariate, multivariate feature selection approach, missing values ratio, high correlation filter, low variance filter, feature selection using decision tree, Feature reduction Techniques: Principal Component Analysis, Linear Discriminate Analysis

Recommender System: Content based system, Collaborative filtering based

UNIT III

Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes, Logistic Regression

Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem

UNIT IV

Artificial Neural Networks: Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm

UNIT V

Ensembles: Introduction, Bagging and boosting, Random forest, Discussion on some research papers. Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering

TEXTBOOKS

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.

REFERENCES

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 336 L	Machine Learning Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Basic exercises on Python Machine Learning Packages such as Numpy, Pandas and matplotlib
2. Python exercise on Feature engineering, data visualisation
3. Programs on Covariance, Correlation, Covariance Matrix and Correlation Matrix
4. Implement Linear Regression and calculate sum of residual error
5. Program to implement different distance functions
6. Program to implement decision tree learning
7. Program to implement K nearest neighbour classifier
8. Program to implement Principle Component Analysis
9. Program to implement perceptron for different learning task
10. Programs to implement ADALINE and MADALINE for given learning task
11. Program to implement classification task using Support Vector machine
12. Programs to implement different Clustering algorithms

REFERENCE BOOKS

1. Swamynathan, Manohar. Mastering machine learning with python in six steps: A practical implementation guide to predictive data analytics using python. Apress, 2019.
2. Raschka, Sebastian. Python machine learning. Packt publishing ltd, 2015.

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 338	Applied Data Science	E	3	0	0	3

UNIT I: INTRODUCTION

Introduction to Data Science, Data vs. Big Data, Statistical Inference - Populations and samples, Statistical modeling, probability distributions, fitting a model. Data Science Process, Exploratory Data Analysis, Basic tools - plots, graphs and summary statistics of EDA. Introduction to R Programming.

UNIT II

Basic Machine Learning Algorithms - Linear Regression - K-Nearest Neighbors (K-NN) - K-means, K-Medoids, Naive Bayes. Case Study: Real Direct (online real estate firm), Filtering Spam - Linear Regression and K-NN and Naive Bayes for Filtering Spam. Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and Feature Selection (Extracting Meaning from Data) - Motivating Application and Case Study: User (customer) retention - Feature Generation - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests.

UNIT III

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis.

UNIT IV

Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs.

UNIT V

Data Visualization - Basic principles, ideas and tools for data visualization – Case Study 1 on industry projects – Case Study 2: Create Complex visualization dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - Next-generation data scientists.

TEXTBOOKS

1. Sinan Ozdemir, Sunil Kakade. Principles of Data Science - Second Edition Released December 2018 Publisher(s): Packt Publishing ISBN: 9781789804546.
2. Cathy O'Neil and Rachel Schutt Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.

REFERENCES

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman Mining of Massive Datasets v2.1, Cambridge University Press 2014 (free online).
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.

3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman Elements of Statistical Learning, Second Edition ISBN 0387952845 2009 (free online).
5. Avrim Blum, John Hopcroft and Ravindran Kannan Foundations of Data Science (Note: this is a book currently being written by the three authors. The authors have made the first draft of their notes for the book available online. The material is intended for a modern theoretical course in computer science.)
6. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
7. Jiawei Han, Micheline Kamber and Jian Pei Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790 2011.

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 338 L	Applied Data Science Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Write a python program to apply datafication concepts of friendship network of your face book account.
2. Write python program to calculate the central tendency of any popular data set. The inbuilt functions in the python should not be used.
3. Write R – Programming to plot various charts and graphs. You have to consider minimum two popular data sets and draw all the statistical observations.
4. Write a python Program to apply EDA on any two popular data sets and provided your analysis and interpretations. Use matplotlib library of python along with other libraries for the analysis and interpretation.
5. Write Python program to implement Linear Regression using inbuilt python Library. Also, write your own program to implement Linear Regression without using the inbuilt function. Compare and contrast the results.
6. Write Python program to implement K-Nearest Neighbors using inbuilt python Library. Also, write your own program to implement K-Nearest Neighbors without using the inbuilt function. Compare and contrast the results.
7. Write Python program to implement K-Means using inbuilt python Library. Also, write your own program to implement K-Means without using the inbuilt function. Compare and contrast the results.
8. Write a python program to implement a Spam Filter using Linear Regression and K-NN. Use a popular dataset.
9. Write a Python Program to Scrapping the Web using suitable API. Create a usable dataset for classification and clustering purpose.
10. Write a python program to generate the features from the data set created by you for exercise 9.
11. Write a Python Program to implement Filter and Wrappers.
12. Write a Python Program to implement Decision Trees, Random Forests – The inbuilt functions should not be used for the implementation.
13. Write a python Program to implement Singular Value Decomposition and Principal Component Analysis. Use any popular data set.
14. Write a python Program to extract the friendship details of your face book account as Social network Graph and represent in various visual forms.
15. Write a python program to extend the above exercise to discover the communities in the graph, partition the graph and extracting the neighbor hood properties of the graphs.
16. Write Python Program using Bokeh 2.1.1 realize the all the basic principles of data visualization.
17. Consider any popular dataset and present complex visualization principle using Bokeh 2.1.1.

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 314	Digital Image Processing	E	3	0	0	3

UNIT I

Introduction: Digital Image fundamentals: Image sampling and quantization, relationship between pixels, Image acquisition and Pre-processing: Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening.

UNIT II

Filtering in the Frequency Domain: basic filtering in the frequency domain, image smoothing and sharpening Image Restoration: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function.

UNIT III

Image segmentation: Fundamentals, point, line detection, basic edge detection techniques, Hough transform, Thresholding, basic global thresholding, optimal thresholding using Otsu's method, multi-spectral thresholding, Region based segmentation, region growing, region splitting and merging.

UNIT IV

Color Image Processing: color models, Color transformation Image Compression: Fundamentals, Some basic compression methods Morphological Image Processing: Erosion and Dilation, opening and closing, thinning, skeletonisation.

UNIT V

Image Representation: Shape features (Region-based representation and descriptors), area, Euler's number, eccentricity, elongatedness, rectangularity, direction, compactness, moments, covex hull, texture features, color features. Object and Pattern Recognition: Pattern and pattern classes, Matching, minimum distance or nearest neighbor classifier, matching by correlation, Optimum statistical classifier, Neural network classifier.

TEXTBOOKS

1. R.C. Gonzalez, R.E. Woods, Digital Image Processing, 3rd Edition, Pearson Education

REFERENCES

1. S. Sridhar, Digital Image Processing, Oxford University Press, 2011.
2. Milan Sonka, Vaclav Hlavac and Roger Boyele, Image processing, analysis, and machine vision. 3e, Cengage Learning, 2014.
3. Computer Vision A modern approach, David A. Forsyth and Jeam Ponce, Pearson Education.

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 314 L	Digital Image Processing Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Perform the following operations using library functions
    a. Read, Display and write any color image in other formats.
    b. Find RED, GREEN and BLUE plane of the color image.
    c. Convert color image into gray scale image and binary image.
    d. Resize the image by one half and one quarter.
    e. Image rotates by 45, 90 and 180 degrees.
2. Create black and white images (A) of size 1024x1024. Which consists of alternative horizontal lines of black and white? Each line is of size 128.
   Create black and white images (B) of size 1024x1024. Which consists of alternative vertical lines of black and white? Each line is of size128.Perform the following operations on Image A and Image B.
    a. Image addition of A and B
    b. Subtraction of A and B
    c. Multiplying Images of A and B
    a. Create a grayscale image of size 256x1024. Intensity of image should vary sinusoidal.
    b. Create a white image of size 256x256, with black box of size 58x58 at centre.
3. Develop programs for following intensity transformation operation on a gray scale image. Collect any gray scale image from any source. Process that image using these operations.
    a. Image negative
    b. Log transformation and inverse log transform: $s = c \log (1+r)$, c is a const, $r \geq 0$. s is pixel intensity of output image; r is the pixel intensity of input image. Study the effect of constant c on the quality of output image.
    c. Power law transformation: Study the effect of different values of Gamma used in this transformation.
    d. Contrast stretching
    e. Gray level slicing
4. Develop programs for following spatial filtering operations on a gray scale image.
    a. Averaging: Implement averaging filtering operations for different window sizes and study their effect on the quality of output image. Write your observations on output image quality.
    b. Weighted averaging: Implement weighted averaging filtering operations for different window sizes and study their effect on the quality of output image. Write your observations on output image quality.
    c. Median filtering: Implement weighted averaging filtering operations for different window sizes and study their effect on the quality of output image. Write your observations on output image quality.
    d. Max filtering
    e. Min filtering

5. Take a gray scale image and add salt and pepper noise. Write programs for following operations and observe their outputs
    a. Linear smoothing or Image averaging
    b. Weighted averaging
    c. Median filtering. Compare the output quality among Image averaging and median filtering.
    d. Max filtering
    e. Min filtering
6. Write programs to perform following sharpening operations on a gray scale image
    a. Laplacian filter
    b. Filtering using composite mask
    c. Unsharp masking
    d. High boost filtering
    e. Filtering using first order derivative operators such as sobel and prewitt mask.
7. Write a program to improve contrast of an image using histogram equalization. The prototype of the function is as below:

    histogram_equalisation (input_Image, no_of_bins);

    The function should return the enhanced image. Consider two low contrast input images. Study the nature of the output image quality in each case by varying the number of bins.
8. Take a low contrast gray scale image (A) and a high contrast gray scale image (B). Write a program to improve the contrast of A with the help of image B using histogram specification or matching. The prototype of the function is as below:

    Histogram_sp(input_Image, specified_Iage, no_of_bins);

    The function should return the enhanced image.
9. Develop programs to implement frequency domain smoothing filters (Ideal, Butterworth and Gaussian) and apply these filters on a gray scale image.
    a. Compare/comment on the output of Ideal, Butterworth and Gaussian Low pass Filters having the same radii (cutoff frequency) value.
    b. Consider a suitable gray scale image and demonstrate the ringing effect on the output of Ideal low pass frequency domain filter.
    c. Compare the output of Butterworth low pass filters (order n=2) for different cut-off frequencies (5, 15, 30, 90, 120).
    d. Compare the output of Gaussian low pass filters for different cut-off frequencies (5, 15, 30, 90, and 120).
10. Develop programs to implement frequency domain sharpening/High pass filters (Ideal, Butterworth and Gaussian) and apply these filters on a gray scale image.
    a. Compare/comment on the output of Ideal, Butterworth and Gaussian High pass Filters having the same radii (cutoff frequency) value.
    b. Consider a suitable gray scale image and demonstrate the ringing effect on the output of Ideal high pass frequency domain filter.
    c. Compare the output of Butterworth high pass filters (order n=2) for different cut-off frequencies (5, 15, 30, 90, 120).
    d. Compare the output of Gaussian high pass filters for different cut-off frequencies (5, 15, 30, 90, and 120).
11. Develop program to add different types of noise in a gray scale image and write functions to implement following filters for image restoration in presence of these noises.

a. Remove Salt and Pepper Noise
b. Minimize Gaussian noise
c. Median filter and Weiner filter

12. Write and execute program for image morphological operations erosion and dilation.
13. Implement Morphological smoothing using opening and closing
14. Develop program to implement point and line detection masks. Detect points and lines using these masks for a given gray scale image.
15. Develop programs for edge detection using different edge detection mask.
16. Develop programs to achieve image segmentation using
17. Basic Global thresholding
18. Optimal global thresholding or Otsu's thresholding
19. Given a set of coordinates as boundary pixels in an image. Write a program to implement Hough Transform for joining the points using different lines.
20. Given a MXN image. Write a program to find the Co-occurrence matrix for a given angle and distance. Compute the Co-occurrence matrix features.
21. Given a MXN image. Write a program to find the Local Binary Pattern profile of the given image.

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 417	Principles of Big Data Management	E	3	0	0	3

UNIT I

Understanding Big Data – Concepts and Terminology – Big Data Characteristics – Different types of Data – Big Data Storage concepts – Clusters – File systems and distributed file systems – NoSQL – Sharding – Replication – CAP theorem – BASE - Hadoop Distributed File System (HDFS) Architecture - HDFS commands for loading/getting data - Accessing HDFS through Java program.

UNIT II

Big Data Processing Concepts – Parallel Data Processing – Distributed Data Processing – Hadoop – Processing workloads – Batch processing with MapReduce – Map and Reduce Tasks – MapReduce Example

UNIT III

Hadoop ecosystem and its components– Flume - Sqoop - Pig - Spark - Hbase.

UNIT IV

Querying big data with Hive: Introduction to Hive QL - Hive QL: data definition- data manipulation – Hive QL Queries.

UNIT V

Data Analytics using R: Introduction to R, Creating a dataset, Getting started with graphs, Basic data management, Advanced data management.

TEXTBOOKS/REFERENCES

1. Big Data Fundamentals: concepts, Drivers and Techniques: Person Education, 2016
2. Hadoop The Definitive Guide, IV edition, O'Reilly publications
3. Hadoop in Action, Chuck lam, Manning publications
4. Programming, Hive, O'Reily publications,
5. Apache Hive Cookbook, PACKT publications
6. R in Action, Robert I. Kabacoff, Manning publications
7. Practical Data Science with R, Nina Zumel John Mount, Manning publications.

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 417 L	Principles of Big Data Management Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1.a. Hadoop Installation
b. Hadoop Shell Commands
2.a. Writing a file from local file system to Hadoop Distributed file system (HDFS)
b. Reading a file from HDFS to the local file system.
3.a. Implementation of Word Count program using MapReduce without combiner logic.
b. Implementation of Word Count program using MapReduce with combiner logic**.**
4.Weather data analysis for analyzing hot and cold days using MapReduce.
5. Implementation of MapReduce algorithm for Matrix Multiplication.
6. Implement a MapReduce program to identify "common friends" among all pairs of users.
7. Transfer data between Hadoop and relational database servers using Sqoop.
8. Read a text file from HDFS into RDD using Spark.
9. Use HiveQL to analyze the stock exchange dataset and calculate the covariance between the stocks for each month. This will help a stock-broker in recommending the stocks to his customers.
10. Implement JOINS using HIVE
a. Inner Join
b. Left outer join
c. Right outer Join
d. Full outer join

11. Write a R program to create a student record using the Vector concept.
12. Write a R program to create medical patient's status using data frame
i) Patient age ii) Gender iii) Symptoms iv) Patient Status

13. Write a R program to visualize student marks of various subjects using Bar-chart and Scatter plot.

SEMESTER-V

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 240	Industrial Standard Coding Practice -3	DC	0	0	4	1

UNIT I
Problem solving with - Descriptive statistics, Mean/median/mode, Measures of dispersion/range variance, deviations, mean/median/mode problems, Random variables, Univariate & Bivariate random variables.

UNIT II
Problem solving with - Graphs, Handshaking Lemma, Simple Graphs, DFS/BFS, connected components, coloring, Introduction to DAGs, Spanning Trees, Articulation Points/ Connected points.

UNIT III
Problem solving with - Greedy Methods: Coin change, Fractional Knapsack, Activity Selections/ Job sequencing with Deadlines, Spanning Trees, Dynamic Programming: 0/1 Knapsack, Substructures, Longest common substring/subsequence, Longest Increasing sub sequence, Grid based Problems.

UNIT IV
Problem solving with - Divide & Conquer Strategies: Quick/Merge Sort, Min/Power functions, Backtracking, N Queens problem, Finding the path & Grid based problems, iterative/loop free approaches.

UNIT V
R Language Constructs, calculations, Operators, vectors, lists, Practice problems implementing R language, Matrices and data frame, Conditional statements and loops, Problem Solving on R language examples.

TEXTBOOKS

1. An Introduction to Statistical Learning: with Applications in R - Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani.
2. Introduction to Algorithms by Thomas H. Corman, The MIT Press, 3rd Edition.
3. Introduction to Algorithms: A Creative Approach by Udi Mander, Pearson.
4. R Cookbook - Paul Teetor, O'reilly.
5. Competitive Programming – 3e – Steven Halim, Felix Halim.

SEMESTER –VI

SEMESTER-VI

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 412	Principles of Soft Computing	HC	3	0	0	3

UNIT I: INTRODUCTION TO SOFT COMPUTING, ARTIFICIAL NEURAL NETWORK (ANN)

Fundamentals of ANN, Basic Models of an artificial Neuron, Neural Network Architecture, learning methods, Terminologies of ANN, Hebb network, Supervised Learning Networks: Perceptron, Adaline, Madeline, Multi-Layer Perceptron, Feed forward Back Propagation Network: back propagation learning, Learning Effect of Tuning parameters of the Back propagation.

UNIT II: RBF NETWORK, ASSOCIATIVE MEMORY

Auto, hetero and linear associative memory, network, Adaptive Resonance Theory: ART1, ART2, Introduction to Computer vision, Introduction to Convolutional neural network, Popular architectures: AlexNet, GoogleNet, VGG Net.

UNITIII: FUZZY LOGIC

Fuzzy set theory: crisp sets, fuzzy sets, crisp relations, fuzzy relations, Fuzzy Systems: Crisp logic predicate logic, fuzzy logic, fuzzy Rule based system, Defuzzification Methods, Fuzzy rule-based reasoning.

UNIT IV: GENETIC ALGORITHMS

Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction. Genetic Modeling: Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Bitwise operators used in GA. Convergence of Genetic algorithm. Applications, Real life Problems. Particle Swarm Optimization and its variants.

UNIT V

Hybrid Soft Computing Techniques Hybrid system, neural Networks, fuzzy logic and Genetic algorithms hybrids. Genetic Algorithm based Back Propagation Networks: GA based weight determination applications: Fuzzy logic controlled genetic Algorithms soft computing tools, Applications.

TEXTBOOKS

1. Principles of Soft Computing- S.N.Sivanandan and S.N.Deepa, Wiley India, 2nd Edition,2011

REFERENCES

1. Fuzzy and Soft Computing, J. S. R. JANG, C.T. Sun, E. Mitzutani, PHI.
2. Neural Networks, Fuzzy Logic, and Genetic Algorithm (synthesis and Application) S.Rajasekaran, G.A. Vijayalakshmi Pai, PHI.

SEMESTER-VI

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 412 L	Principles of Soft Computing Lab	HC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Write a Python Program to implement a perceptron. The input is your semester marks.
2. Write a python program to extend the exercise given above to implement Feed Forward Network. The inbuilt function should not be used.
3. Write a python program to implement Hebb Network. The inbuilt function should not be used.
4. Write a python program to implement Multilayer Perceptron. The inbuilt function should not be used.
5. Write a python program to implement any ANN with back propagation learning Algorithm.
6. Write a Python Program to implement ART1 and ART 2.
7. Write a python program to implement CNN.
8. Write a python Programming to realize the working principles of popular architectures such as Alex Net, Google Net and VGG Net.
9. Write python Program to realize Fuzzy Sets arithmetic.
10. Write a python Program to realize fuzzy relations.
11. Write a python program to realize a fuzzy rule of any popular problem(s).
12. Write a python program to realize a defuzzification scheme for the above exercise.
13. Write a python Program to reason the fuzzy rules in exercises 12 and 13.
14. Write a python program to realize various steps of Genetic Algorithms.
15. Write a Python Program to realize GA based back propagation Networks.
16. Write a Python Program to realize Fuzzy Controlled Genetic Algorithms.

SEMESTER-VI

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 419	Information Retrieval	HC	3	0	0	3

UNIT I

Introduction to information retrieval, IR problem, IR system, The Web, Search interface, Visualizing search interface, Inverted index and boolean queries, Tokenization, Stemming, Stop words, Phrases, Phrases queries, Index construction, Index compression, k-gram indexes

UNIT II

Retrieval models: Boolean, Vector space model, TF-IDF, The cosine measure, Document length normalization, Probabilistic models, Binary Independence Model, Okapi, Language modeling,

Evaluating IR system: User happiness, Precision, Recall, F-measure, E-measure, Normalized recall, Evaluation problems

UNIT III

Relevance feedback and Query expansion: Explicit relevance feedback, Explicit relevance feedback through clicks, Implicit feedback through local analysis, Implicit feedback through global analysis

Document format, Markup language, Text properties, Document processing, Document organization, Text compression, Query languages, Query properties

UNIT IV

Text/Document classification, Clustering and LSI: Introduction to classification, Naive Bayes models, Rocchio classification, k-Nearest Neighbors, Support vector machine classifiers, Decision trees, Bagging, Boosting, Choosing right classifier

Introduction to clustering, Evaluation of clustering, k-means clustering, Hierarchical agglomerative clustering, Divisive clustering; Low-rank approximations, Latent semantic indexing

UNIT V

Web IR: Hypertext, Web crawling, Indexes, Search engines, Ranking, Link analysis, Page Rank, HITS

TEXTBOOKS/REFERENCES

1. Modern Information Retrieval: The Concepts and Technology Behind Search, by Ricardo Baeza-Yates and Berthier Ribeiro-Neto, Second Edition (Pearson Education India, 2010)
2. Introduction to Information Retrieval, by C. Manning, P. Raghavan, and H. Schütze (Cambridge University Press, 2008)
3. Mining the Web, by S. Chakrabarti (Morgan-Kaufmann, 2002)
4. Natural Language Processing And Information Retrieval, by Tanveer Siddiqui and U. S. Tiwary, First Edition (Oxford University Press, 2008)

SEMESTER-VI

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 419 L	Information Retrieval Lab	DC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Tokenization, Stemming, Stop words removal, Inverted index construction - Token sequence, Sort, Dictionary & Postings, Implementation of Boolean queries.
2. Ranked retrieval - Implementation of TF-IDF, Vector space model, Cosine similarity.
3. Ranked retrieval - Implementation of Binary Independence Model, Okapi BM25.
4. Implementation of Text/Document classification algorithms - Naive Bayes models, Rocchio classification, k-Nearest Neighbors, Support vector machine classifiers, Decision trees, Bagging, Boosting.
5. Implementation of Text/Document clustering algorithms - k-means clustering, Hierarchical agglomerative clustering, Divisive clustering.
6. Implementation of Low-rank approximations, Latent semantic indexing.
7. Sort-based index construction.
8. Implementation of External memory indexing - BSBI, SPIMI.
9. Implementations of Dynamic indexing - Logarithmic merge.
10. Dictionary compression - Implementation of Blocking, Posting Compression - Implementation of Gamma codes.
11. Development of a Web Crawler and a small-scale web search engine - Ranking, PageRank, HITS.

SEMESTER-VI

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 340	Project	C	0	0	8	4

General Guidelines for project report and Research work.

These guidelines explain briefly the mechanics of writing a research paper in Computer Science and Engineering. These guidelines are generic and can be customized to fit most of the research works

The writing can start with the abstract, which can be approximately one page 10–20 sentences. The abstract will be refined and updated as a continuous process. The abstract can concisely (1) identify the research topic, (2) identify the benefits and advantages that result (3) and if there is novelty, describe the novelty of the presented work.

Section 1: Introduction (Motivation) Although the title of the starting section is "Introduction" it should really be Motivation. In one or two paragraphs, the topic has to be introduced. This is followed with useful of the work, including possible applications of the work. Possible points to mention include:

1. Does the research work describe the state-of-the-art in that research domain?
2. What is the relevance of this work in filling any research gap?
3. Who will potentially benefit from the work?
4. Does the presented work provide a new technique of some sort?
5. Does this research work provide any new insight in some way?
6. Is it a review work which give an insight to the current research in a particular domain?

Words like, contribute, benefit, advantageous, and possibly novel are used in this list. The presented work often builds on a previous system or algorithm. If so, your work may inherit benefits from the previous work. Those inherited advantages may also be listed. The introduction section then concludes with how the rest of the research paper is organized.

Section 2: Related works: presents review of the previous work on this topic
The related work section demonstrates to the reader that you have done your homework (research), reviewed the previous literature, and now are ready to present your contribution based what has been previously published. The review is confined to relevant and recent research works in the domain of the proposed research. One of the difficult aspects of the related work section is choosing the proper scope. There is some subjectivity in choosing which books or papers to refer to and also importantly, which previous literature not to refer to. This is something an advisor is able to help with.

Section 3: presents the proposed work/experimental/simulation specifications.

Section 4: presents any algorithms or procedures used.

Next section can represent an evaluation of the results and the

Last section may present conclusions and future work.

Citations

Any figure, image, or equation that is taken from another source must be cited. Content and terminology from other sources must also be cited. For more information about citations and their use, see:

http://www.plagiarism.org/. Click on the "How to cite sources" link.

References should be accurate and complete, i.e., with page numbers etc. A paper without complete and correct references can leave a bad impression on the reader and detract from a paper's credibility.

Mark Distribution: (As per the original plan. May be reviewed)

1. Internal evaluation by Guide: 50 marks
2. External evaluation by a Committee: 50 marks
   (Project Report, Demonstration and Presentation)

Honors in AI & ML

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 102	Introduction to Programming Using Python	HC	3	0	0	3

UNIT I: INTRODUCTION TO PYTHON

Knowledge, Machines, Languages, Types, Variables Operators and Branching -– Core elements of programs: Bindings, Strings, Input/Output, IDEs, Control Flow, Iteration, Guess and Check – Simple Programs: Approximate Solutions, Bisection Search, Floats and Fractions, Newton-Raphson.

UNIT II: FUNCTIONS

Decomposition and Abstraction, Functions and Scope, Keyword Arguments, Specifications, Iteration vs Recursion, Inductive Reasoning, Towers of Hanoi, Fibonacci, Recursion on non-numeric, Files.

UNIT III: TUPLES AND LISTS

Tuples, Lists, List Operations, Mutation, Aliasing, Cloning – Dictionaries: Functions as Objects, Dictionaries, Example with a Dictionary, Fibonacci and Dictionaries, Global Variables – Debugging: Programming Challenges, Classes of Tests, Bugs, Debugging, Debugging Examples– Assertions and Exceptions, Assertions, Exceptions, Exception Examples.

UNIT IV: CLASSES AND INHERITANCE

Object Oriented Programming, Class Instances, Methods Classes Examples, Why OOP, Hierarchies, Your Own Types – An Extended Example: Building a Class, Visualizing the Hierarchy, adding another Class, Using Inherited Methods, Gradebook Example, Generators.

UNIT V: COMPUTATIONAL COMPLEXITY

Program Efficiency, Big Oh Notation, Complexity Classes Analyzing Complexity – Searching and Sorting Algorithms: Indirection, Linear Search, Bisection Search, Bogo and Bubble Sort, Selection Sort, Merge Sort.

TEXTBOOKS

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT).

REFERENCES

1. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10June2017),ISBN-10: 0199480173.
2. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016).
3. Fundamentals of Python first Programmes by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1stedition (6th February 2009).

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 102 L	Introduction to Programming Using Python Lab	HC	0	0	3	2

LIST OF PRACTICAL EXPERIMENTS

11. A company decided to give bonus of 5% to employee if his/her year of service is more than 5 years. Ask user for their salary and year of service and print the net bonus amount.
12. Write a program that computes the real roots of a quadratic function. Your program should begin by prompting the user for the values of a, b and c. Then it should display a message indicating the nature of real roots, along with the values of the real roots (if any).
13. Write a Python program to find the factorial of the given number (Example: 5! = 5*4*3*2*1 =120).
14. Write a Python program to read the numbers from the keyboard using a loop, perform the sum and average of all the input numbers until "-10" is encountered.
15. Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.
16. Write a python program for bubble sort algorithm. What is the best case and worst-case time complexity of Bubble sort algorithm? Explain with an example, where the list of elements is not sorted then what would be the output after each iteration/pass.
17. Write a python program for Selection sort algorithm. What is the worst case or average case time complexity of selection sort algorithm?
18. Write a Program in python using object-oriented concept to make calculator which has the following operations: Addition, Subtraction, Multiplications, Divisions, Exponentials, Modulus.
19. Define is inheritance? Explain with suitable example: Single level inheritance, Multiple Inheritance, Multi-level Inheritance.
20. Write a Program in python using object-oriented concept to create a base class called Polygon and there are three derived classes named as triangle, rectangle and square. The base class consists of the input function for accepting sides length and the derived classes must have output function for displaying area of triangle, rectangle and square.

TEXTBOOKS

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT).
2. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017), ISBN-10: 0199480173.
3. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016).

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 413	Artificial Intelligence	HC	3	0	0	3

UNIT I

Introduction: What is Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents.

UNIT II

Search: Introduction to Search, Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, current-best-hypothesis search, least commitment search

UNIT III

Knowledge Representation and Reasoning: Inference, Propositional Logic, Predicate Logic (first order logic), Logical Reasoning, Forward &Backward Chaining, Resolution; AI languages and tools - Lisp, Prolog, CLIPS

UNIT IV

Problem Solving: Formulating problems, problem types, Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods.

UNIT V

Learning: Overview of different forms of learning, decision trees, rule based learning, neural networks, reinforcement learning.

Game playing: Perfect decision game, imperfect decision game, evaluation function, minimax, alpha-beta pruning.

TEXTBOOKS

1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, Pearson Education
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, McGraw-Hill
3. E Charniak and D McDermott, “Introduction to Artificial Intelligence”, Pearson Education
4. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 413 L	Artificial Intelligence Lab	HC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Week 1: Artificial Intelligence Problem identification and PEAS description.
2. Week 2: Introduction to AI programming Language PROLOG.
3. Week 3: Study of facts, objects, predicates and variables in PROLOG.
4. Week 4: Study of arithmetic operators, simple input/output and compound goals in PROLOG.
5. Week 5: Study of string operations in PROLOG. Implement string operations like substring,
6. string position, palindrome etc.
7. Week 6: Write a prolog program to implement all set operations (Union, intersection,
8. complement etc.
9. Week 7: Write a program for Usage of rules in Prolog.
   Create a family tree program to include following rules 1. M is the mother of P *if* she is a parent of P and is female 2. F is the father of P *if* he is a parent of P and is male 3. X is a sibling of Y *if* they both have the same parent. 4. Then add rules for grandparents, uncle-aunt, sister and brother. Based on the facts, define goals to answer questions related to
10. Week 8: Write programs for studying Usage of arithmetic operators in Prolog.
    Accept name of the student, roll no, his/her subject name, maximum marks and obtained marks in the subject. (Take marks of at least 6 subjects). Compute the percentage of a student. Display his result with other information.
    Accept department, designation, name, age, basic salary, house rent allowance (HRA) of an employee. Compute dearness allowance (DA) which is 15% of basic salary. Determine the gross salary (basic salary+HRA+DA) of the employee. Display all information of the employee (Generate Payslip).
11. Week 9: Implement a program for recursion and list in PROLOG.
12. Week 10: WAP for studying usage of compound object and list in Prolog.
    Write a program to maintain inventory items using a compound object:
    (i) Accept from user the details of at least 10 objects. (ii)Display from user the details of objects entered by user (2) Find and display odd and even numbers from a given input list.
13. Week 11: Write a prolog program to solve “Water Jug Problem”.
14. Week 12: Write a program to implement a monkey banana problem.
15. Week 13: Write a program to implement 8 Queens Problem.
16. Week 14: Write a program to solve traveling salesman problem.
17. Week 15: Write a program to solve water jug problem using LISP.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 336	Machine Learning	HC	3	0	0	3

UNIT I

Introduction: Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance

Linear Regression: Introduction, Linear regression, Simple and Multiple Linear regression, Polynomial regression, evaluating regression fit.

UNIT II

Decision tree learning: Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, over fitting in decision tree and methods to avoid over fitting.

Instance based Learning: K nearest neighbour, theCurse of Dimensionality, Feature Selection: univariate, multivariate feature selection approach, missing values ratio, high correlation filter, low variance filter, feature selection using decision tree, Feature reduction Techniques: Principal Component Analysis, Linear Discriminate Analysis

Recommender System: Content based system, Collaborative filtering based

UNIT III

Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes, Logistic Regression

Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem.

UNIT IV

Artificial Neural Networks: Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm.

UNIT V

Ensembles: Introduction, Bagging and boosting, Random forest, Discussion on some research papers.

Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering.

TEXTBOOKS

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.

REFERENCES

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 336 L	Machine Learning Lab	HC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Basic exercises on Python Machine Learning Packages such as Numpy, Pandas and matplotlib
2. Python exercise on Feature engineering, data visualisation
3. Programs on Covariance, Correlation, Covariance Matrix and Correlation Matrix
4. Implement Linear Regression and calculate sum of residual error
5. Program to implement different distance functions
6. Program to implement decision tree learning
7. Program to implement K nearest neighbour classifier
8. Program to implement Principle Component Analysis
9. Program to implement perceptron for different learning task
10. Programs to implement ADALINE and MADALINE for given learning task
11. Program to implement classification task using Support Vector machine
12. Programs to implement different Clustering algorithms

REFERENCES

1. Swamynathan, Manohar. Mastering machine learning with python in six steps: A practical implementation guide to predictive data analytics using python. Apress, 2019.
2. Raschka, Sebastian. Python machine learning. Packt publishing ltd, 2015.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 314	Digital Image Processing	HC	3	0	0	3

UNIT I

Introduction: Digital Image fundamentals: Image sampling and quantization, relationship between pixels, Image acquisition and Pre-processing: Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening.

UNIT II

Filtering in the Frequency Domain: basic filtering in the frequency domain, image smoothing and sharpening Image Restoration: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function.

UNIT III

Image segmentation: Fundamentals, point, line detection, basic edge detection techniques, Hough transform, Thresholding, basic global thresholding, optimal thresholding using Otsu's method, multi-spectral thresholding, Region based segmentation, region growing, region splitting and merging.

UNIT IV

Color Image Processing: color models, Color transformation Image Compression: Fundamentals, Some basic compression methods Morphological Image Processing: Erosion and Dilation, opening and closing, thinning, skeletonisation.

UNIT V

Image Representation: Shape features (Region-based representation and descriptors), area, Euler's number, eccentricity, elongatedness, rectangularity, direction, compactness, moments, covex hull, texture features, color features. Object and Pattern Recognition: Pattern and pattern classes, Matching, minimum distance or nearest neighbor classifier, matching by correlation, Optimum statistical classifier, Neural network classifier.

TEXTBOOKS

2. R.C. Gonzalez, R.E. Woods, Digital Image Processing, 3rd Edition, Pearson Education

REFERENCES

4. S. Sridhar, Digital Image Processing, Oxford University Press, 2011.
5. Milan Sonka, Vaclav Hlavac and Roger Boyele, Image processing, analysis, and machine vision. 3e, Cengage Learning, 2014.
6. Computer Vision A modern approach, David A. Forsyth and Jeam Ponce, Pearson Education.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 314 L	Digital Image Processing Lab	HC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

22. Perform the following operations using library functions
    f. Read, Display and write any color image in other formats.
    g. Find RED, GREEN and BLUE plane of the color image.
    h. Convert color image into gray scale image and binary image.
    i. Resize the image by one half and one quarter.
    j. Image rotates by 45, 90 and 180 degrees.
23. Create black and white images (A) of size 1024x1024. Which consists of alternative horizontal lines of black and white? Each line is of size 128.
    Create black and white images (B) of size 1024x1024. Which consists of alternative vertical lines of black and white? Each line is of size128.Perform the following operations on Image A and Image B.
    d. Image addition of A and B
    e. Subtraction of A and B
    f. Multiplying Images of A and B
    c. Create a grayscale image of size 256x1024. Intensity of image should vary sinusoidal.
    d. Create a white image of size 256x256, with black box of size 58x58 at centre.
24. Develop programs for following intensity transformation operation on a gray scale image. Collect any gray scale image from any source. Process that image using these operations.
    f. Image negative
    g. Log transformation and inverse log transform: $s = c \log (1+r)$, c is a const, $r \geq 0$. s is pixel intensity of output image; r is the pixel intensity of input image. Study the effect of constant c on the quality of output image.
    h. Power law transformation: Study the effect of different values of Gamma used in this transformation.
    i. Contrast stretching
    j. Gray level slicing
25. Develop programs for following spatial filtering operations on a gray scale image.
    f. Averaging: Implement averaging filtering operations for different window sizes and study their effect on the quality of output image. Write your observations on output image quality.
    g. Weighted averaging: Implement weighted averaging filtering operations for different window sizes and study their effect on the quality of output image. Write your observations on output image quality.
    h. Median filtering: Implement weighted averaging filtering operations for different window sizes and study their effect on the quality of output image. Write your observations on output image quality.
    i. Max filtering
    j. Min filtering

26. Take a gray scale image and add salt and pepper noise. Write programs for following operations and observe their outputs
    f. Linear smoothing or Image averaging
    g. Weighted averaging
    h. Median filtering. Compare the output quality among Image averaging and median filtering.
    i. Max filtering
    j. Min filtering
27. Write programs to perform following sharpening operations on a gray scale image
    f. Laplacian filter
    g. Filtering using composite mask
    h. Unsharp masking
    i. High boost filtering
    j. Filtering using first order derivative operators such as sobel and prewitt mask.
28. Write a program to improve contrast of an image using histogram equalization. The prototype of the function is as below:
    histogram_equalisation (input_Image, no_of_bins);
    The function should return the enhanced image. Consider two low contrast input images. Study the nature of the output image quality in each case by varying the number of bins.
29. Take a low contrast gray scale image (A) and a high contrast gray scale image (B). Write a program to improve the contrast of A with the help of image B using histogram specification or matching. The prototype of the function is as below:
    Histogram_sp(input_Image, specified_Iage, no_of_bins);
    The function should return the enhanced image.
30. Develop programs to implement frequency domain smoothing filters (Ideal, Butterworth and Gaussian) and apply these filters on a gray scale image.
    e. Compare/comment on the output of Ideal, Butterworth and Gaussian Low pass Filters having the same radii (cutoff frequency) value.
    f. Consider a suitable gray scale image and demonstrate the ringing effect on the output of Ideal low pass frequency domain filter.
    g. Compare the output of Butterworth low pass filters (order n=2) for different cut-off frequencies (5, 15, 30, 90, 120).
    h. Compare the output of Gaussian low pass filters for different cut-off frequencies (5, 15, 30, 90, and 120).
31. Develop programs to implement frequency domain sharpening/High pass filters (Ideal, Butterworth and Gaussian) and apply these filters on a gray scale image.
    e. Compare/comment on the output of Ideal, Butterworth and Gaussian High pass Filters having the same radii (cutoff frequency) value.
    f. Consider a suitable gray scale image and demonstrate the ringing effect on the output of Ideal high pass frequency domain filter.
    g. Compare the output of Butterworth high pass filters (order n=2) for different cut-off frequencies (5, 15, 30, 90, 120).
    h. Compare the output of Gaussian high pass filters for different cut-off frequencies (5, 15, 30, 90, and 120).
32. Develop program to add different types of noise in a gray scale image and write functions to implement following filters for image restoration in presence of these noises.

d. Remove Salt and Pepper Noise
e. Minimize Gaussian noise
f. Median filter and Weiner filter

33. Write and execute program for image morphological operations erosion and dilation.
34. Implement Morphological smoothing using opening and closing
35. Develop program to implement point and line detection masks. Detect points and lines using these masks for a given gray scale image.
36. Develop programs for edge detection using different edge detection mask.
37. Develop programs to achieve image segmentation using
38. Basic Global thresholding
39. Optimal global thresholding or Otsu's thresholding
40. Given a set of coordinates as boundary pixels in an image. Write a program to implement Hough Transform for joining the points using different lines.
41. Given a MXN image. Write a program to find the Co-occurrence matrix for a given angle and distance. Compute the Co-occurrence matrix features.
42. Given a MXN image. Write a program to find the Local Binary Pattern profile of the given image.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 412	Principles of Soft Computing	HC	3	0	0	3

UNIT I: INTRODUCTION TO SOFT COMPUTING, ARTIFICIAL NEURAL NETWORK (ANN)

Fundamentals of ANN, Basic Models of an artificial Neuron, Neural Network Architecture, learning methods, Terminologies of ANN, Hebb network, Supervised Learning Networks: Perceptron, Adaline, Madeline, Multi-Layer Perceptron, Feed forward Back Propagation Network: back propagation learning, Learning Effect of Tuning parameters of the Back propagation.

UNIT II: RBF NETWORK, ASSOCIATIVE MEMORY

Auto, hetero and linear associative memory, network, Adaptive Resonance Theory: ART1, ART2, Introduction to Computer vision, Introduction to Convolutional neural network, Popular architectures: AlexNet, GoogleNet, VGG Net.

UNITIII: FUZZY LOGIC

Fuzzy set theory: crisp sets, fuzzy sets, crisp relations, fuzzy relations, Fuzzy Systems: Crisp logic predicate logic, fuzzy logic, fuzzy Rule based system, Defuzzification Methods, Fuzzy rule-based reasoning.

UNIT IV: GENETIC ALGORITHMS

Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction. Genetic Modeling: Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Bitwise operators used in GA. Convergence of Genetic algorithm. Applications, Real life Problems. Particle Swarm Optimization and its variants.

UNIT V

Hybrid Soft Computing Techniques Hybrid system, neural Networks, fuzzy logic and Genetic algorithms hybrids. Genetic Algorithm based Back Propagation Networks: GA based weight determination applications: Fuzzy logic controlled genetic Algorithms soft computing tools, Applications.

TEXTBOOKS

2. Principles of Soft Computing- S.N.Sivanandan and S.N.Deepa, Wiley India, 2nd Edition,2011

REFERENCES

3. Fuzzy and Soft Computing, J. S. R. JANG, C.T. Sun, E. Mitzutani, PHI.
4. Neural Networks, Fuzzy Logic, and Genetic Algorithm (synthesis and Application) S.Rajasekaran, G.A. Vijayalakshmi Pai, PHI.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 412 L	Principles of Soft Computing Lab	HC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

17. Write a Python Program to implement a perceptron. The input is your semester marks.
18. Write a python program to extend the exercise given above to implement Feed Forward Network. The inbuilt function should not be used.
19. Write a python program to implement Hebb Network. The inbuilt function should not be used.
20. Write a python program to implement Multilayer Perceptron. The inbuilt function should not be used.
21. Write a python program to implement any ANN with back propagation learning Algorithm.
22. Write a Python Program to implement ART1 and ART 2.
23. Write a python program to implement CNN.
24. Write a python Programming to realize the working principles of popular architectures such as Alex Net, Google Net and VGG Net.
25. Write python Program to realize Fuzzy Sets arithmetic.
26. Write a python Program to realize fuzzy relations.
27. Write a python program to realize a fuzzy rule of any popular problem(s).
28. Write a python program to realize a defuzzification scheme for the above exercise.
29. Write a python Program to reason the fuzzy rules in exercises 12 and 13.
30. Write a python program to realize various steps of Genetic Algorithms.
31. Write a Python Program to realize GA based back propagation Networks.
32. Write a Python Program to realize Fuzzy Controlled Genetic Algorithms.

Honours in Data Science

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 102	Introduction to Programming Using Python	HC	3	0	0	3

UNIT I: INTRODUCTION TO PYTHON

Knowledge, Machines, Languages, Types, Variables Operators and Branching -– Core elements of programs: Bindings, Strings, Input/Output, IDEs, Control Flow, Iteration, Guess and Check – Simple Programs: Approximate Solutions, Bisection Search, Floats and Fractions, Newton-Raphson.

UNIT II: FUNCTIONS

Decomposition and Abstraction, Functions and Scope, Keyword Arguments, Specifications, Iteration vs Recursion, Inductive Reasoning, Towers of Hanoi, Fibonacci, Recursion on non-numeric, Files.

UNIT III: TUPLES AND LISTS

Tuples, Lists, List Operations, Mutation, Aliasing, Cloning – Dictionaries: Functions as Objects, Dictionaries, Example with a Dictionary, Fibonacci and Dictionaries, Global Variables – Debugging: Programming Challenges, Classes of Tests, Bugs, Debugging, Debugging Examples– Assertions and Exceptions, Assertions, Exceptions, Exception Examples.

UNIT IV: CLASSES AND INHERITANCE

Object Oriented Programming, Class Instances, Methods Classes Examples, Why OOP, Hierarchies, Your Own Types – An Extended Example: Building a Class, Visualizing the Hierarchy, adding another Class, Using Inherited Methods, Gradebook Example, Generators.

UNIT V: COMPUTATIONAL COMPLEXITY

Program Efficiency, Big Oh Notation, Complexity Classes Analyzing Complexity – Searching and Sorting Algorithms: Indirection, Linear Search, Bisection Search, Bogo and Bubble Sort, Selection Sort, Merge Sort.

TEXTBOOKS

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT).

REFERENCES

1. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10June2017), ISBN-10: 0199480173.
2. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016).
3. Fundamentals of Python first Programmes by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1st edition (6th February 2009).

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 102 L	Introduction to Programming Python Lab	HC	0	0	3	2

LIST OF PRACTICAL EXPERIMENTS

1. A company decided to give bonus of 5% to employee if his/her year of service is more than 5 years. Ask user for their salary and year of service and print the net bonus amount.
2. Write a program that computes the real roots of a quadratic function. Your program should begin by prompting the user for the values of a, b and c. Then it should display a message indicating the nature of real roots, along with the values of the real roots (if any).
3. Write a Python program to find the factorial of the given number (Example: 5! = 5*4*3*2*1 =120).
4. Write a Python program to read the numbers from the keyboard using a loop, perform the sum and average of all the input numbers until "-10" is encountered.
5. Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.
6. Write a python program for bubble sort algorithm. What is the best case and worst-case time complexity of Bubble sort algorithm? Explain with an example, where the list of elements is not sorted then what would be the output after each iteration/pass.
7. Write a python program for Selection sort algorithm. What is the worst case or average case time complexity of selection sort algorithm?
8. Write a Program in python using object-oriented concept to make calculator which has the following operations: Addition, Subtraction, Multiplications, Divisions, Exponentials, Modulus.
9. Define is inheritance? Explain with suitable example: Single level inheritance, Multiple Inheritance, Multi-level Inheritance.
10. Write a Program in python using object-oriented concept to create a base class called Polygon and there are three derived classes named as triangle, rectangle and square. The base class consists of the input function for accepting sides length and the derived classes must have output function for displaying area of triangle, rectangle and square.

TEXTBOOKS

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT).
2. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017), ISBN-10: 0199480173.
3. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016).

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSE 310	Data Warehousing and Mining	HC	3	0	0	3

UNIT I

Data warehousing and Online Analytical Processing: Basic concepts of Data Warehouse – Data Warehouse Modelling – Data Warehouse Design and Usage – Data Warehouse Implementation – Data Generalization by Attribute-oriented Induction.

UNIT II

Data Mining: Knowledge Discovery from Data – Types of Data - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration – Data Reduction – Data Transformation and Data Discretization. Association Rule Mining – Frequent Itemset Mining methods – Pattern Evaluation Methods.

UNIT III

Classification – Basic Concepts – Decision Tree Induction – Bayes Classification Methods – Rule based Classification – Model Evaluation and Selection – Techniques to improve Classification Accuracy

UNIT IV

Clustering – Cluster Analysis – Partitioning Methods – Hierarchical Methods – Density-Based Methods – Grid Based Methods – Evaluation of Clustering.

UNIT V

Data Mining Trends and Research Frontiers - Mining Complex Data types – Other Methodologies of Data Mining – Data Mining Applications – Data Mining and Society – Data Mining trends.

TEXTBOOKS

1. Jiawei Han, Micheline Kamber and Jian Pei “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2011.

REFERENCES

1. G. K. Gupta “Introduction to Data Mining with Case Studies”, Third Edition, Prentice Hall of India, 2014.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar “Introduction to Data Mining”, Pearson Education, 2016.
3. K.P. Soman, Shyam Diwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
4. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSE 310 L	Data Warehousing and Data Mining Lab	HC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. **Week 1:** Implementation of OLAP operations.
2. **Week 2:** Data pre-processing techniques.
3. **Week 3:** Write a program in any programming language to generate at least 10,000 transactions in a text file with at least three items.
4. **Week 4 & 5:** Write a program to implement the APRIORI algorithm.
5. **Week 6 & 7:** Write a program for FP-Growth algorithm.
6. **Week 8 & 9:** Write a program to implement Decision tree-based classification.
7. **Week 10 & 11:** Write a program to implement Bayesian classification.
8. **Week 12:** Write a program to implement K-means clustering.
9. **Week 13:** Write a program to implement Divisive clustering.
10. **Week 14:** Write a program to implement Agglomerative clustering.
11. **Week 15:** Write a program to implement DBSCAN clustering.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 338	Applied Data Science	HC	3	0	0	3

UNIT I: INTRODUCTION

Introduction to Data Science, Data vs. Big Data, Statistical Inference - Populations and samples, Statistical modeling, probability distributions, fitting a model. Data Science Process, Exploratory Data Analysis, Basic tools - plots, graphs and summary statistics of EDA. Introduction to R Programming.

UNIT II

Basic Machine Learning Algorithms - Linear Regression - K-Nearest Neighbors (K-NN) - K-means, K-Medoids, Naive Bayes. Case Study: Real Direct (online real estate firm), Filtering Spam - Linear Regression and K-NN and Naive Bayes for Filtering Spam. Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and Feature Selection (Extracting Meaning from Data) - Motivating Application and Case Study: User (customer) retention - Feature Generation - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests.

UNIT III

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis.

UNIT IV

Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs.

UNIT V

Data Visualization - Basic principles, ideas and tools for data visualization – Case Study 1 on industry projects – Case Study 2: Create Complex visualization dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - Next-generation data scientists.

TEXTBOOKS

3. Sinan Ozdemir, Sunil Kakade. Principles of Data Science - Second Edition Released December 2018 Publisher(s): Packt Publishing ISBN: 9781789804546.
4. Cathy O'Neil and Rachel Schutt Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.

REFERENCES

8. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman Mining of Massive Datasets v2.1, Cambridge University Press 2014 (free online).
9. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
10. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
11. Trevor Hastie, Robert Tibshirani and Jerome Friedman Elements of Statistical Learning, Second Edition ISBN 0387952845 2009 (free online).

12. Avrim Blum, John Hopcroft and Ravindran Kannan Foundations of Data Science (Note: this is a book currently being written by the three authors. The authors have made the first draft of their notes for the book available online. The material is intended for a modern theoretical course in computer science.)
13. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
14. Jiawei Han, Micheline Kamber and Jian Pei Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790 2011.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 338 L	Applied Data Science Lab	DC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

18. Write a python program to apply datafication concepts of friendship network of your face book account.
19. Write python program to calculate the central tendency of any popular data set. The inbuilt functions in the python should not be used.
20. Write R – Programming to plot various charts and graphs. You have to consider minimum two popular data sets and draw all the statistical observations.
21. Write a python Program to apply EDA on any two popular data sets and provided your analysis and interpretations. Use matplotlib library of python along with other libraries for the analysis and interpretation.
22. Write Python program to implement Linear Regression using inbuilt python Library. Also, write your own program to implement Linear Regression without using the inbuilt function. Compare and contrast the results.
23. Write Python program to implement K-Nearest Neighbors using inbuilt python Library. Also, write your own program to implement K-Nearest Neighbors without using the inbuilt function. Compare and contrast the results.
24. Write Python program to implement K-Means using inbuilt python Library. Also, write your own program to implement K-Means without using the inbuilt function. Compare and contrast the results.
25. Write a python program to implement a Spam Filter using Linear Regression and K-NN. Use a popular dataset.
26. Write a Python Program to Scrapping the Web using suitable API. Create a usable dataset for classification and clustering purpose.
27. Write a python program to generate the features from the data set created by you for exercise 9.
28. Write a Python Program to implement Filter and Wrappers.
29. Write a Python Program to implement Decision Trees, Random Forests – The inbuilt functions should not be used for the implementation.
30. Write a python Program to implement Singular Value Decomposition and Principal Component Analysis. Use any popular data set.
31. Write a python Program to extract the friendship details of your face book account as Social network Graph and represent in various visual forms.
32. Write a python program to extend the above exercise to discover the communities in the graph, partition the graph and extracting the neighbor hood properties of the graphs.
33. Write Python Program using Bokeh 2.1.1 realize the all the basic principles of data visualization.
34. Consider any popular dataset and present complex visualization principle using Bokeh 2.1.1.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 417	Principles of Big Data Management	HC	3	0	0	3

UNIT I

Understanding Big Data – Concepts and Terminology – Big Data Characteristics – Different types of Data – Big Data Storage concepts – Clusters – File systems and distributed file systems – NoSQL – Sharding – Replication – CAP theorem – BASE - Hadoop Distributed File System (HDFS) Architecture - HDFS commands for loading/getting data - Accessing HDFS through Java program.

UNIT II

Big Data Processing Concepts – Parallel Data Processing – Distributed Data Processing – Hadoop – Processing workloads – Batch processing with MapReduce – Map and Reduce Tasks – MapReduce Example

UNIT III

Hadoop ecosystem and its components– Flume - Sqoop - Pig - Spark - Hbase.

UNIT IV

Querying big data with Hive: Introduction to Hive QL - Hive QL: data definition- data manipulation – Hive QL Queries.

UNIT V

Data Analytics using R: Introduction to R, Creating a dataset, Getting started with graphs, Basic data management, Advanced data management.

TEXTBOOKS/REFERENCES

8. Big Data Fundamentals: concepts, Drivers and Techniques: Person Education, 2016
9. Hadoop The Definitive Guide, IV edition, O'Reilly publications
10. Hadoop in Action, Chuck lam, Manning publications
11. Programming, Hive, O'Reily publications,
12. Apache Hive Cookbook, PACKT publications
13. R in Action, Robert I. Kabacoff, Manning publications
14. Practical Data Science with R, Nina Zumel John Mount, Manning publications.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 417 L	Principles of Big Data Management Lab	HC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1.a. Hadoop Installation
b. Hadoop Shell Commands
2.a. Writing a file from local file system to Hadoop Distributed file system (HDFS)
b. Reading a file from HDFS to the local file system.
3.a. Implementation of Word Count program using MapReduce without combiner logic.
b. Implementation of Word Count program using MapReduce with combiner logic**.**
4.Weather data analysis for analyzing hot and cold days using MapReduce.
5. Implementation of MapReduce algorithm for Matrix Multiplication.
6. Implement a MapReduce program to identify "common friends" among all pairs of users.
7. Transfer data between Hadoop and relational database servers using Sqoop.
8. Read a text file from HDFS into RDD using Spark.
9. Use HiveQL to analyze the stock exchange dataset and calculate the covariance between the stocks for each month. This will help a stock-broker in recommending the stocks to his customers.
10. Implement JOINS using HIVE
a. Inner Join
b. Left outer join
c. Right outer Join
d. Full outer join

11. Write a R program to create a student record using the Vector concept.
12. Write a R program to create medical patients status using data frame
i) Patient age ii) Gender iii) Symptoms iv) Patient Status

13. Write a R program to visualize student marks of various subjects using Bar-chart and Scatter plot.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 419	Information Retrieval	HC	3	0	0	3

UNIT I

Introduction to information retrieval, IR problem, IR system, The Web, Search interface, Visualizing search interface, Inverted index and boolean queries, Tokenization, Stemming, Stop words, Phrases, Phrases queries, Index construction, Index compression, k-gram indexes

UNIT II

Retrieval models: Boolean, Vector space model, TF-IDF, The cosine measure, Document length normalization, Probabilistic models, Binary Independence Model, Okapi, Language modeling,

Evaluating IR system: User happiness, Precision, Recall, F-measure, E-measure, Normalized recall, Evaluation problems

UNIT III

Relevance feedback and Query expansion: Explicit relevance feedback, Explicit relevance feedback through clicks, Implicit feedback through local analysis, Implicit feedback through global analysis

Document format, Markup language, Text properties, Document processing, Document organization, Text compression, Query languages, Query properties

UNIT IV

Text/Document classification, Clustering and LSI: Introduction to classification, Naive Bayes models, Rocchio classification, k-Nearest Neighbors, Support vector machine classifiers, Decision trees, Bagging, Boosting, Choosing right classifier

Introduction to clustering, Evaluation of clustering, k-means clustering, Hierarchical agglomerative clustering, Divisive clustering; Low-rank approximations, Latent semantic indexing

UNIT V

Web IR: Hypertext, Web crawling, Indexes, Search engines, Ranking, Link analysis, Page Rank, HITS

TEXTBOOKS/REFERENCES

5. Modern Information Retrieval: The Concepts and Technology Behind Search, by Ricardo Baeza-Yates and Berthier Ribeiro-Neto, Second Edition (Pearson Education India, 2010)
6. Introduction to Information Retrieval, by C. Manning, P. Raghavan, and H. Schütze (Cambridge University Press, 2008)
7. Mining the Web, by S. Chakrabarti (Morgan-Kaufmann, 2002)
8. Natural Language Processing And Information Retrieval, by Tanveer Siddiqui and U. S. Tiwary, First Edition (Oxford University Press, 2008)

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 419 L	Information Retrieval Lab	DC	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

12. Tokenization, Stemming, Stop words removal, Inverted index construction - Token sequence, Sort, Dictionary & Postings, Implementation of Boolean queries.
13. Ranked retrieval - Implementation of TF-IDF, Vector space model, Cosine similarity.
14. Ranked retrieval - Implementation of Binary Independence Model, Okapi BM25.
15. Implementation of Text/Document classification algorithms - Naive Bayes models, Rocchio classification, k-Nearest Neighbors, Support vector machine classifiers, Decision trees, Bagging, Boosting.
16. Implementation of Text/Document clustering algorithms - k-means clustering, Hierarchical agglomerative clustering, Divisive clustering.
17. Implementation of Low-rank approximations, Latent semantic indexing.
18. Sort-based index construction.
19. Implementation of External memory indexing - BSBI, SPIMI.
20. Implementations of Dynamic indexing - Logarithmic merge.
21. Dictionary compression - Implementation of Blocking, Posting Compression - Implementation of Gamma codes.
22. Development of a Web Crawler and a small-scale web search engine - Ranking, PageRank, HITS.

Computer Science General Elective

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 320	Web Programming	E	3	0	0	3

UNIT I

Introduction to internet-Introduction to World Wide Web (WWW)-Web browsers-Web servers-Uniform Resource Locator (URL)- Introduction to Hyper Text Markup Language (HTML)-Standard HTML document structure-Text and Paragraph formatting- Lists in HTML-Handling of images in web pages-Hyperlinks- -Tables-Iframes in HTML-Forms in HTML-HTML Graphics-HTML Media

UNIT II

Introduction to Cascading Style Sheets (CSS)-CSS versions-The specification of CSS-Applying style to a document-Media types-Document structure and CSS inheritance-Selectors in CSS-Major themes of CSS-Style inclusion methods-CSS strings and keywords-CSS color values-Background attachment-border in CSS-Counter in CSS-Basics of Web fonts-CSS animations- CSS tool tips-CSS Image reflections-CSS grid container.

UNIT III

Overview of JavaScript-General syntactic characteristics of JavaScript-Primitives, Operations and Expressions-Control statements-Arrays-Functions-Constructors-Pattern matching using regular expressions-Error handling in JavaScript-Events and event handling-Document Object Model (DOM)- Dynamic documents with JavaScript-Positioning elements-moving elements-Changing colors and font-Dynamic content management-stacking elements-Locating mouse curser and Reacting to mouse click-Dragging and dropping elements

UNIT IV

Introduction to Hypertext Preprocessor (PHP)-General syntactic characteristics-Primitives, operations and expressions-Control statements-Arrays-Functions-Pattern matching in PHP-Form handling-Cookies and Session tracking-MySQL connectivity and various database operations with PHP

UNIT V

Introduction to Ajax-Ajax technology-Implementing Ajax-Applications-Ajax request-Ajax response-Ajax XML-Introduction to JSON-JSON syntax-JSON data types-JSON arrays-Introduction to Web APIs- Types of Web APIs-Examples of web APIs.

TEXTBOOKS

1. **T**homas A. Powell, The Complete Reference HTML & CSS, Mc Graw Hill Publishers, Fifth Edition, 2017
2. Robert W. Sebesta, Programming the World Wide Web, Pearson Publishers, Eighth Edition, 2014.

REFERENCES

1. Richard Blum, PHP, MySQL & JavaScript All-in-one, Wiley, 2018.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 321	Human Computer Interaction	E	3	0	0	3

UNIT I: FOUNDATIONS OF HCI

The Human: I/O channels – Memory – Reasoning and problem solving - The computer: Devices – Memory – Processing and networks - Interaction: Models – frameworks – Ergonomics – styles – elements – Interactivity- Paradigms.

UNIT II: DESIGN AND SOFTWARE PROCESS

Interactive design basics – Process – Scenarios – Navigation – Screen design – Iteration and prototyping - HCI in software process – Software life cycle – Usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III: MODELS AND THEORIES

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration Models-Hypertext, Multimedia and WWW.

UNIT IV: MOBILE HCI

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V: WEB INTERFACE DESIGN

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

TEXTBOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, Pearson Education.
2. Brian Fling, “Mobile Design and Development”, O’Reilly Media Inc. Bill Scott and Theresa Neil, “Designing Web Interfaces”, O’Reilly.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 322	Advanced Computer Architecture	E	3	0	0	3

UNIT I: INSTRUCTION LEVEL PARALLELISM

ILP – Concepts and challenges – Hardware and software approaches – Dynamic scheduling – Speculation - Compiler techniques for exposing ILP – Branch prediction.

UNIT II: MULTIPLE ISSUE PROCESSORS

VLIW & EPIC – Advanced compiler support – Hardware support for exposing parallelism– Hardware versus software speculation mechanisms – IA 64 and Itanium processors–Limits on ILP.

UNIT III: MULTIPROCESSORS AND THREAD LEVEL PARALLELISM

Symmetric and distributed shared memory architectures – Performance issues – Synchronization – Models of memory consistency – Introduction to Multithreading.

UNIT IV: MEMORY AND I/O

Cache performance – Reducing cache miss penalty and miss rate – Reducing hit time – Main memory and performance – Memory technology. Types of storage devices – Buses – RAID – Reliability, availability and dependability – I/O performance measures – Designing an I/O system.

UNIT V: MULTI-CORE ARCHITECTURES

Software and hardware multithreading – SMT and CMP architectures – Design issues – Case studies – Intel Multi-core architecture – SUN CMP architecture - heterogeneous multi-core processors – case study: IBM Cell Processor.

TEXTBOOKS

1. John L. Hennessey and David A. Patterson, “Computer architecture – A quantitative approach”, Morgan Kaufmann / Elsevier Publishers, 4th. edition, 2007.

REFERENCES

1. David E. Culler, Jaswinder Pal Singh, “Parallel computing architecture: A hardware/software approach”, Morgan Kaufmann /Elsevier Publishers, 1999.
2. Kai Hwang and Zhi.Wei Xu, “Scalable Parallel Computing”, Tata McGraw Hill, New Delhi, 200

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 323	Natural Language Processing	E	3	0	0	3

UNIT I: INTRODUCTION

Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues – Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.

UNIT II: WORD LEVEL AND SYNTACTIC ANALYSIS

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and Correction-Words and Word Classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

UNIT III: SEMANTIC ANALYSIS AND DISCOURSE PROCESSING

Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: Cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT IV: NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION

Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation-Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

UNIT V: INFORMATION RETRIEVAL AND LEXICAL RESOURCES

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame Net-Stemmers-POS Tagger- Research Corpora.

TEXTBOOKS

1. Daniel Jurafsky, James H. Martin, “Speech & language processing”, Pearson publications.
2. James Allen, Natural Language Understanding. The Benajmins/Cummings Publishing Company Inc. 1994. ISBN 0-8053-0334-0
3. Bird, Steven, Ewan Klein, and Edward Loper, Natural language processing with Python: Analyzing text with the natural language toolkit, O'Reilly Media, Inc, 2009.
4. Manning, Christopher, and Hinrich Schutze. Foundations of statistical natural language processing. MIT press, 1999.

REFERENCES

1. Pierre M. Nugues, “An Introduction to Language Processing with Perl and Prolog”, Springer.
2. Cover, T. M. and J. A. Thomas, Elements of Information Theory, Wiley, 1991. ISBN 0-471-06259-6.

3. Charniak, E.: Statistical Language Learning. The MIT Press. 1996. ISBN 0-262-53141-0.
4. Tom Mitchell, Machine Learning. McGraw Hill, 1997. ISBN 0070428077.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 324	Computer Graphics	E	3	0	0	3

UNIT I: INTRODUCTION

Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors, and workstations and input devices Output primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill, and flood-fill algorithms.

UNIT II: 2-D GEOMETRICAL TRANSFORMS

Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.
2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

UNIT III: 3-D OBJECT REPRESENTATION

Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curves, Bezier and B-spline surfaces. Basic illumination models, polygon rendering methods.
3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

UNIT IV: VISIBLE SURFACE DETECTION METHODS

Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods.

UNIT V: COMPUTER ANIMATION

Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications

TEXTBOOKS

1. Computer Graphics with Virtual Reality System, Rajesh K. Maurya, Wiley Dreamtech.
2. Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education

REFERENCES

1. Computer Graphics Principle and Practice, J.D. Foley, A.Dam, S.K. Feiner, Addison, Wesley
2. “Procedural elements for Computer Graphics”, David F Rogers, Tata Mc Graw hill, 2nd edition.
3. “Principles of Interactive Computer Graphics”, Neuman and Sproul, TMH.
4. Principles of Computer Graphics”, Shalini, Govil-Pai, Springer.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSE 325	Advanced Data Structures and Algorithms	E	3	0	0	3

UNIT I: ADVANCED DATA STRUCTURES

Strategies for choosing the appropriate data structures-Heaps, AVL Trees (Search, Insertion, Deletion, Red-Black Trees (Search, Insertion and Deletion), Splay Trees (Search, Insertion and Deletion), B-trees, B+ Trees (Search, Insertion and Deletion), Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures.

UNIT II: GRAPHS & ALGORITHMS

Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, Topological sort, Max flow: Ford Fulkerson algorithm, max flow – min cut, Dynamic Graphs, Few Algorithms for Dynamic Graphs, Union-Find Algorithms.

UNIT III: GEOMETRIC ALGORITHMS

Point location, Convex hulls and Voronoi diagrams, Arrangements, graph connectivity, Network Flow and Matching: Flow Algorithms - Maximum Flow – Cuts - Maximum Bipartite Matching - Graph partitioning via multi-commodity flow, Karger'r Min Cut Algorithm, String matching and document processing algorithms.

UNIT IV: APPROXIMATION ALGORITHMS

Approximation algorithms for known NP hard problems - Analysis of Approximation Algorithms. Use of Linear programming and primal dual, Local search heuristics. Parallel algorithms: Basic techniques for sorting, searching, merging, list ranking in PRAMs and Interconnection.

UNIT V: RANDOMIZED ALGORITHMS

Introduction, Type of Randomized Algorithms, Min- Cut, 2-SAT, Game Theoretic Techniques, Random Walks. Online Algorithms: Introduction, Online Paging Problem, Adversary Models, k-server Problem

TEXTBOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, Third Edition, The MIT Press, 2009.

REFERENCES

1. Sahni, Sartaj, Data Structures, Algorithms and Applications in C++, MIT Press (2005)
2. Roger Sedgewick and Kevin Wayne, Algorithms, Addison-Wesley Professional 2011.
3. Allan Borodin and Ran El-Yaniv: Online Computation and Competitive Analysis, Cambridge University Press, 2005.
4. Sanjoy Dasgupta, Christos Papadimitriou and Umesh Vazirani, “Algorithms”, Tata McGraw-Hill, 2009.
5. RK Ahuja, TL Magnanti and JB Orlin, “Network flows: Theory, Algorithms, and Applications”, Prentice Hall Englewood Cliffs, NJ 1993.
6. Rajeev Motwani, Prabhakar Raghavan: Randomized Algorithms, Cambridge University Press, 1995.
7. Jiri Matousek and Bernd Gärtner: Understanding and Using Linear Programming, 2006.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 326	Distributed Operating Systems	E	3	0	0	3

UNIT I: FUNDAMENTALS

What is distributed operating system, issues in designing distributed operating system, Computer networks: Lan, WAN technologies, communication protocols, internetworking, Message passing: Issues in IPC by message passing, synchronization, buffering group communication, case study.

UNIT II: REMOTE PROCEDURE CALLS

The RPC model, Implementing RPC, RPCs in heterogeneous environment, lightweight RPC, case study. Distributed shared memory: General architecture of DSM systems, Design and implementation issues of DSM, Consistency models, Replacement strategies, Advantages of DSM.

UNIT III: PROCESS MANAGEMENT

Introduction, Process migration, Threads. Synchronization: Clock synchronization, event ordering, Mutual exclusion, deadlock, Election Algorithms. Resource management: Global scheduling algorithm, Task assignment, Load sharing and balancing approaches.

UNIT IV: DISTRIBUTED FILE SYSTEM

Desirable features of a good DFS, file models, file accessing models, file sharing semantics, file caching schemes, file replication, fault tolerance, atomic transactions, Design principles, Case study: Google DFS and Hadoop DFS.

UNIT V: NAMING

Desirable features of a good naming system, system-oriented names, object locating mechanisms, human oriented names, name caches, naming and security. Security: potential attacks, cryptography, authentication, access control, digital signatures, design principles.

TEXTBOOKS/REFERENCES

1. Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.
2. Advanced Concepts in Operating Systems, Mukesh Singhal and Niranjan Shivratri, Mc Graw hill publications, 2017.
3. Andrew S. Tanenbaul, Maarten Van Steen, Distributed Systems, Principles and Paradigms, Pearson publications, 2nd edition.

Course Code	Course name	Course Category	Credits			
			L	T	P	C
CSC 420	Data and Web Mining	E	3	0	0	3

UNIT I: INTRODUCTION TO DATA MINING

What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics. Data Mining Goals. Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods. Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model, OLAP operations.

UNIT II: DATA PRE-PROCESSING

Data cleaning. Data transformation, Data reduction. Data mining knowledge representation, Attribute-oriented analysis. Data mining algorithms: Association rules: Motivation and terminology, Basic idea: item sets, generating item sets and rules efficiently, Correlation analysis.

UNIT III: DATA MINING ALGORITHMS

Classification, Basic learning/mining tasks, inferring rudimentary rules: 1R algorithm, Decision trees, Covering rules. Data mining algorithms: Prediction, The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbour), Linear models.

UNIT IV: WEB CRAWLING

Basic crawler algorithm, Focused crawlers, Topical crawlers, Web search: Web page pre-processing, Inverted index, HITS algorithm, Page ranking algorithm, Leadership algorithm.

UNIT V: SOCIAL NETWORK ANALYSIS

Co-citation and bibliographic coupling, Community discovery. Web usage mining: Recommender systems. Mining Twitter, Mining Face book, Mining Instagram.

TEXTBOOKS/REFERENCES

1. Han, J., Kamber, M., & Pei, J. (2011). Data mining: Concepts and techniques (3rd ed.). Morgan Kaufmann publications.
2. Introduction to Data Mining, Vipin kumar, Michael Steinbach, Pang-Ning Tan, Person publications,2016
3. Mining the Web, Soumen Chakrabarti, Elseier publications, 2002
4. Web Data Mining, Bing Liu, Second Edition, Springer publications, 2011.
5. Mining the Social Web, Mathew A. Russel, Mikhail Klassen, Third edition, Oreily publications, 2018.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 421	Complexity Theory	E	3	0	0	3

UNIT I: COMPUTABILITY

A recap of automata theory and the Church-Turing Thesis Computational models: Lambda calculus, Turing machine Decidability Reducibility. The PCP problem & Mapping reducibility The Recursion Theorem Definition of Information.

UNIT II: TIME COMPLEXITY

Measuring Complexity, Big-O and small-o notation, Analyzing algorithms. Complexity relationships among computational models The Class-P, Examples The Class-NP, Examples The P versus NP question NP-completeness The Cook-Levin Theorem Additional NP-completeness Problems.

UNIT III: SPACE COMPLEXITY

Space complexity. Savitch's Theorem and NL. NL-completeness and log-space reductions. From P-completeness to PSPACE-completeness. The Classes L and NL NL completeness, NL equals coNL.

UNIT IV: INTERACTABILITY

Hierarchy Theorems Relativization Circuit Complexity.

UNIT V: ADVANCED TOPICS IN COMPLEXITY THEORY

Approximation Algorithms Probabilistic Algorithms Alternation Interactive Proof Systems.

TEXTBOOKS

1. Introduction to the Theory of Computation - Michael Sipser (Primary Textbook).
2. Computational Complexity - Arora Barak (Reference).

Course Code	Course name	Course Category	Credits			
			L	T	P	C
CSC 422	Software Project Management	E	3	0	0	3

UNIT I: SOFTWARE MANAGEMENT & ECONOMICS

SDLC -waterfall model Conventional Software Management Performance Evolution of Software Economics – Software economics Pragmatic software cost estimation Reducing software product size Improving software processes Improving team effectiveness Improving automation through software environment.

UNIT II: THE OLD AND THE NEW WAY OF PROJECT MANAGEMENT

The principles of conventional software engineering Principles of modern software management, Transitioning to an iterative process Basics of Software estimation – Effort and Cost estimation techniques COSMIC Full function points COCOMO-I COCOMO II A Parametric Productivity Model - Staffing Pattern.

UNIT III: SOFTWARE MANAGEMENT PROCESS FRAMEWORK

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 Model based software architectures: A Management perspective. Model based software architectures: Technical perspective Work Flows of the process: Software process workflows Iteration workflows Checkpoints of the process: Major milestones, Minor Milestones, Periodic status assessment.

UNIT IV: PROJECT ORGANIZATION AND PLANNING

Work breakdown structures Planning guidelines. The cost and schedule estimating process The iteration planning process Pragmatic planning Line-of-Business organizations Project organizations, Evolution of organizations Process automation - Automation building Blocks The project environment.

UNIT V: PROJECT CONTROL AND PROCESS INSTRUMENTATION

The Seven-Core metrics: Management indicators The Seven-Core metrics: Quality indicators Life-Cycle expectations, Pragmatic software metrics, Metrics automation Modern project profiles Next generation software economics Modern process transitions.

TEXBOOKS/REFERENCES

1. Walker Royce, “Software Project Management”, 1st Edition, Pearson Education, 2006.
2. Bob huges, Mike cotterell, Rajib Mall “Software Project Management”, 6th Edition, Tata McGraw Hill, 2017.
3. SA Kelkar, Software Project Management: A Concise Study, 3rd Edition, PHI, 2013.
4. Joel Henry, Software Project Management: A Real-World Guide to Success, Pearson Education, 2009.
5. Pankaj Jalote, Software Project Management in Practice, Pearson Education, 2015.
6. https://ocw.mit.edu/courses/engineering-systems-division/esd-36-system-project-management-fall-2012/
7. https://uit.stanford.edu/pmo/pm-life-cycle

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 423	Multimedia	TE	3	0	0	3

UNIT I: INTRODUCTION TO MULTIMEDIA

What is Multimedia, Multimedia and Hypermedia, Overview ofMu1timedia Software Tools Graphics and Multimedia Data Representations: Graphics Image Data Types, File Formats, and representation (image, video, and sound).

UNIT II: COLOUR IN IMAGE AND VIDEO

Color Science, Color' Models in Images, Color Models in Video, Fundamental Concepts in Video, Analog Video, Digital Video Basics of Digital Audio: Digitization of Sound, MIDI: Musical Instrument Digital Interface Quantization and Transmission of Audi.

UNIT III: LOSSLESS COMPRESSION ALGORITHMS

Basics of Infonnation Theory, Run-Length Coding, Variable-Length Coding, Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression Lossy Compression Algorithms: Distortion Measures, The Rate-Distortion Theory Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zerotree of Wavelet Coefficients.

UNIT IV: IMAGE COMPL'ESSION STANDARDS

The JPEG Standard, The JPEG2000 Standard, The JPEG-LS Standard, Bilevel Image Compression Standards.

Basic Video Compression Techniques: Introduction to Video Compression, Video Compression Based on Motion Compensation, Search for Motion Vectors, H.261, H.263.

Basic Audio Compression Techniques: ADPCM in Speech Coding, G.726 ADPCM, Vocoders.

UNIT V: MPEG Video Coding I - MPEG-1 and 2

MPEG-1, MPEG-2 MPEG Video Coding 11- MPEG-4, 7, and Beyond: Overview ofMPEG-4, Object-Based Visual Coding in MPEG-4, Synthetic Object Coding in MPEG-4, MPEG-4 Part10/H.264, MPEG-7, H.265 MPEG Audio Compl'ession: MPEG Audio, Commercial Audio codes.

TEXTBOOKS

1. Fundamentals of Multimedia (FM), Ze-Nian Li, Mark S. Drew, in Prentice Hall, 2004 (Springer 2nd Edition, 2014 with additional author of Dr. Jiangchuan Liu).
2. Digital Multimedia by Chapman (DM), Nigel P./ Chapman, Jenny, in John Wiley & Sons Inc, 2000 (3rd Edition, 2009).

REFERENCES

1. Multimedia: Making It Work, 9 Edition by Vaughan, Tay in McGraw-Hill, 2014.
2. Multimedia: Computing, Communications and Applications by Ralf Steinmetz in Pearson Education, 2012.
3. Recent articles about multimedia (recommended at classes).

Course Code	Course name	Course Category	Credits			
			L	T	P	C
CSC 424	Deep Learning	TE	3	0	0	3

UNIT I: INTRODUCTION

Overview of machine learning, linear classifiers, loss functions.
Introduction to Tensor Flow: Computational Graph, Key highlights, creating a Graph, Regression example, Gradient Descent, Tensor Board, Modularity, Sharing Variables, Keras.

UNIT II: ACTIVATION FUNCTIONS

Sigmoid, ReLU, Hyperbolic Fns, Softmax Perceptrons: What is a Perceptron, XOR Gate.
Artificial Neural Networks: Introduction, Perceptron Training Rule, Gradient Descent Rule, vanishing gradient problem and solution.

UNIT III: CONVOLUTIONAL NEURAL NETWORKS

Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, problem, and solution of under fitting and over fitting.

UNIT IV: RECURRENT NEURAL NETWORKS

Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, GRU, Encoder Decoder architectures.

UNIT V: DEEP LEARNING APPLICATIONS

Image segmentation, Self-Driving Cars, News Aggregation and Fraud News Detection Natural Language Processing, Virtual Assistants, Entertainment, Visual Recognition Fraud Detection, Healthcare.

TEXTBOOKS

1. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Josh Patterson, Adam Gibson, Deep Learning: A Practitioner's Approach, OReilly, 2017.
3. Gulli, Antonio, and Sujit Pal. Deep learning with Keras. Packt Publishing Ltd, 2017.
4. Buduma, Nikhil, and Nicholas Locascio. Fundamentals of deep learning: Designing next-generation machine intelligence algorithms. " O'Reilly Media, Inc.", 2017.

REFERENCES

1. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G., H., and Van Loan, C. F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 425	Advanced Database Management Systems	TE	3	0	0	3

UNIT I

Overview of the DBMS Introduction to DBMS implementation using Megatron 2000 database system Data storage using main memory and hard disks Disk failures Recovery from disk crashes Representing data elements: Record, Representing block and record address Variable length data and records Record modifications.

UNIT II

Index structures: Indexes on sequential files Secondary indexes B-Trees Hash tables Multidimensional indexes: Hash and tree like structures for multidimensional data Bitmap indexes.

UNIT III

Query execution: Algebra for queries Introduction to Physical-Query-Plan Operators One-Pass Algorithms for Database Operations Nested-Loop Joins Two-Pass Algorithms Based on Sorting Two-Pass Algorithms Based on Hashing Index-Based Algorithms Buffer Management Algorithms Using More Than Two Passes Parallel Algorithms for Relational Operations.

UNIT IV

The query compiler: Parsing Algebraic Laws for Improving Query Plans from Parse Trees to Logical Query Plans Estimating the Cost of Operations Introduction to Cost-Based Plan Selection Choosing an Order for Joins Completing the Physical-Query-Plan Selection.

UNIT V

Concurrency control: Conflict-Serializability View serializability Enforcing Serializability by Locks Locking Systems with Several Lock Modes. An Architecture for a Locking Scheduler Concurrency control by timestamps and validation Transactions that Read Uncommitted Data Coping with system failures: Undo/Redo logging Protecting media failures

TEXTBOOKS

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004.
2. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008.

REFERENCES

1. K. V. Iyer, Lecture notes available as PDF file for classroom use.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 426	Fog Computing	E	3	0	0	3

UNIT I: FOG COMPUTING

Limitation of Cloud computing, Differences between Cloud and Fog computing, what is Fog? Advantages of Fog computing, Business Models, Architecture of Fog computing, Opportunities and Challenges.

UNIT II: ADDRESSING THE CHALLENGES IN FOG RESOURCES

Introduction, Taxonomy and Characteristics, Resource Management Challenge, Optimisation challenges, Miscellaneous Challenges, IoT and Fog: Introduction. Programming paradigms for IoT+ Fog, Research challenges and Future Research Directions.

UNIT III: MANAGEMENT AND ORCHESTRATION OF NETWORK

SLICES IN 5G, FOG, EDGE, AND CLOUDS

Introduction, Background, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog, Future Research Directions: Middleware for Fog and Edge Computing: Design Issues, Introduction. Need for Fog and Edge Computing Middleware: Design Goals, State-of-the-Art Middleware Infrastructures, System Model, Clusters for Lightweight Edge Clouds, Architecture Management – Storage and Orchestration, IoT Integration, Security Management for Edge Cloud Architectures, Future Research Directions.

UNIT IV: DATA MANAGEMENT AND ANALYSIS IN FOG COMPUTING

Introduction, Background, Fog Data Management, Future Research and Direction Motivating Example: Smart Building, Predictive Analysis with Fog Torch, Survey of ML Techniques for Defending IoT Devices, Machine Learning in Fog Computing, Future Research Directions.

UNIT V: CASE STUDIES

Case Study 1: Introduction, Human Object Detection, Object Tracking, Lightweight Human Detection.

Case Study 2: Introduction, Data-Driven Intelligent Transportation Systems, Mission-Critical Computing Requirements of Smart Transportation Applications, Fog Computing for Smart Transportation Applications, Case Study 3: Intelligent Traffic Lights Management (ITLM) System, Testing Perspectives.

TEXTBOOKS

1. Fog and Edge Computing, Rajkumar Buyya, Satish Narayana Srirama, Wiley Publications, 2019.
2. Fog computing in the Internet of Things: Springer publications, 2018.

REFERENCES

1. Research papers from IEEE, ACM, Springer and Elsevier)

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 427	Parallel Algorithms	E	3	0	0	3

UNIT I

Sequential model need of alternative model, parallel computational 8 models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

UNIT II

Performance Measures of Parallel Algorithms, speed-up and 8 efficiency of PA, Cost-optimality, an example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models.

UNIT III

Parallel Sorting Networks, Parallel Merging Algorithms on on 8 CREW/EREW/MCC, Parallel Sorting Networks CREW/EREW/MCC/, linear array.

UNIT IV

Parallel Searching Algorithm, Kth element, Kth element in X+Y on 8 PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

UNIT V

Graph Algorithms - Connected Graphs, search and traversal, 8 Combinatorial Algorithms- Permutation, Combinations, Derangements.

TEXTBOOKS

1. M.J. Quinn, “Designing Efficient Algorithms for Parallel Computer”, Mc Graw Hill.
2. S.G. Akl, “Design and Analysis of Parallel Algorithms” 3. S.G. Akl,” Parallel Sorting Algorithm” by Academic Press.

Course Code	Course name	Course Category	CREDITS			
			L	T	P	C
CSC 428	Web Services	E	3	0	0	3

UNIT I

Introduction to Service Oriented Architecture-Goals of service oriented architecture- Introduction to services-The SOA Architectural Stack-Service Composition and Data Flow-Data-Flow Paradigms-Composition Techniques.

UNIT II

Introduction to web services- History of webservices-Web services: communication stack-Simple Object Access Protocol (SOAP)-Web Services Description Language (WSDL)-WSDL Main Elements-Message Communication Model in SOAP/WSDL.

UNIT III

Web Services: REST or Restful Services-REST Design Principles-Web API Design for RESTful Services-Data Services-Implementation of Data Services-XML Transformation and Query Techniques-Consuming data via direct data access to the sources.

UNIT IV

Web Service Composition: Overview-Service Orchestration vs. Service Choreography-Benefits of Web Service Composition-Web Service Composition Environment-Web Service Composition: Control Flows-BPEL (Business Process Execution Language)-BPMN (Business Process Model and Notation)-Web Service Composition: Data Flows-Data-Flow Paradigms.

UNIT V

Introduction to Service Component Architecture (SCA)-The SOA Integration Problem-Overview of SCA-High-level overview of the assembly model-Application of SCA to Use Case-SCA Runtime-Benefits of SCA.

TEXTBOOKS

1. Paik, Hye-young, et al. Web Service Implementation and Composition Techniques. Vol. 256. Springer International Publishing, 2017.
2. Martin Kalin, Java Web Services: Up and Running, O'Reilly publishers, Second edition, 2013.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 429	Advances in Data Mining	E	3	0	0	3

UNIT I

What is Data Mining, Compiling need of Data Mining, Business Data Mining, Data Mining Tools. Data Mining Process, CRISP-DM, Business Understanding, Data Understanding, Data Preparation, Modelling, Evaluation, Deployment. SEMMA, Steps in SEMMA Process, Comparison of CRISP & SEMMA, Handling Data.

UNIT II

Association Rules in Knowledge Discovery, Market-Basket Analysis, Mining Frequent Patterns, Associations, and Correlations, Apriori Algorithm, Pattern-Growth Approach for Mining Frequent Itemsets, Mining Frequent Itemsets using Vertical Data Format, Mining Closed and Max Patterns. Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequent Pattern Mining, Mining High-Dimensional Data and Colossal Patterns, Mining Compressed or Approximate Patterns.

UNIT III

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods: Bayes' Theorem, Na¨ıve Bayesian Classification, Rule-Based Classification. Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Bagging, Boosting and AdaBoost, Random Forests, Improving Classification Accuracy of Class-Imbalanced Data. Other Classification Methods: Genetic Algorithms, Rough Set Approach, Fuzzy Set Approaches.

UNIT IV

Cluster Analysis, Partitioning Methods: k-Means: A Centroid-Based Technique, k-Medoids: A Representative Object-Based Technique. Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, BIRCH: Multiphase Hierarchical Clustering Using Clustering, Feature Trees, Chameleon: Multiphase Hierarchical Clustering Using Dynamic Modelling, Probabilistic Hierarchical Clustering. Density-Based Methods, Grid-Based Methods.

UNIT V

Outliers and Outlier Analysis, Outlier Detection Methods: Supervised, Semi-Supervised, and Unsupervised Methods, Statistical Methods, Proximity-Based Methods, and Clustering-Based Methods, Mining Contextual and Collective Outliers, Outlier Detection in High-Dimensional Data. Mining Complex Data Types, Data Mining Applications, Social Impacts of Data Mining.

TEXTBOOKS

1. Data Mining Concepts and Techniques, Third Edition, by Jiawei Han, Micheline Kamber, and Jian Pei.
2. Olson DL, Delen D. Advanced data mining techniques. Springer Science & Business Media.

REFERENCES

1. Aggarwal CC. Data mining: the textbook. Springer. William.
2. Machine Learning, 2nd edition, by Ethem Alpaydi.

Course Code	Course name	Course Category	Credits			
			L	T	P	C
CSC 303	Computer Networks	E	3	0	0	3

UNIT I: OVERVIEW OF THE INTERNET (PHYSICAL LAYER AND DATA LINK LAYER)

Basic Computer Network concepts, Protocol, Layering Scenario. Layer Architecture: OSI Model, TCP/IP model. Internet history standards and administration; Comparison of the OSI and TCP/IP reference model. Guided transmission media, wireless transmission media. Different LAN topologies: BUS, RING and STAR topology. Data Link layer design issues: Error detection techniques. Error Correction Techniques, Flow control. Sliding Window protocols. Go back N and selective Repeat protocols. Difference between single bit sliding window and n-bit sliding window protocols.

UNIT II: MEDIUM ACCESS CONTROL

Static and Dynamic Channel Allocations. Shared channel Access: Pure ALOHA and slotted ALOHA. Persistent CSMA protocols: 1, P and Non-persistent CSMA protocols. CSMA with collision detection. Comparison of different CSMA protocols. Collision free protocols: Bit-map protocol, Token Ring and Binary Count down protocols. Limited Contention protocols: Adaptive tree walk protocol. Shared medium for wireless networks: CSMA/CA or MACA. Interconnecting LANs: HUBS, Repeaters and Switches and bridges. Spanning tree algorithm for bridges.

UNIT III: NETWORK LAYER

Overview: Connection oriented and connection less services. Comparison of packet switched, and circuit switched networks. Routing: proactive routing and reactive routing protocols, static and dynamic routing protocols. Dijkstra Algorithm, Distance vector routing and Link state routing protocols. Routing in wireless networks: AODV and DSR routing protocols. Overview of IP header and IP addressing. Classful IP addressing: Class A, B, C, D and E. Limitations of classful Addressing, Introduction to Subnet. Overview of Congestion: Warning Bit, Choke packets, Load Shedding, RED (Random Early Detection).

UNIT IV: INTERNETWORKING AND TRANSPORT LAYER

IP Encapsulation and Tunneling. IP packet fragmentation, ICMP, ARP. ICMP, DHCP, Introduction to Transport layer. Different end-to-end transport layer protocols: TCP and UDP. Brief explanation of TCP protocol. Packet formats for TCP and UDP protocol.

UNIT V: TRANSPORT AND APPLICATION PROTOCOLS

TCP Connection Management Modeling. TCP Sliding Window. TCP congestion control. Introduction to application layer paradigms. Client Server model. Introduction and overview of HTTP protocol. Overview of FTP protocol. Operation of Electronic Mail. Introduction to peer-to-peer communication models. Introduction and overview of TELNET. Importance of Security in computer Networks.

TEXTBOOKS

1. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
2. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.

REFERENCES

1. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 303 L	Computer Networks Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Explain about wire shark and display how to send packets or packets from one layer another.
2. Write a Java program to implement Error Detection Technique using CRC Algorithm.
3. Write a Java program to implement Error Correction Technique using Hamming code.
4. Write a Java program to implement TCP Client Server programming.
5. Write a Java program to implement UDP Client Server Programming.
6. Write a Java program to implement 1-bit Stop and Wait Protocol at data link layer.
7. Write a Java program to implement N-bit Sliding Window Protocol at data link layer.
8. Write a Java program to implement Dijkstra Shortest path routing protocol.
9. Write a Java program to implement Distance Vector Routing.
10. Write a Java program to implement echo command in client server socket programming
11. Write a Java program to implement Trace-route command.
12. Write a Java program to implement Ping command.
13. Write a Java program to display the class of IP address, network mask and generate t subnet IP address based on the subnet bits entered from the keyboard.
14. Write a Java program to implement sliding window protocol at the transport layer.
15. Write a Java program to transfer file using TCP?

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 305	Software Engineering	E	3	0	0	3

UNIT I: SOFTWARE PROCESS AND AGILE DEVELOPMENT

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile Process-Extreme programming-XP Process.

UNIT II: REQUIREMENTS ANALYSIS AND SPECIFICATION

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirement's elicitation and analysis, requirements validation, requirements Management-Classical analysis: Structured system Analysis, Petri Nets-Data Dictionary.

UNIT III: SOFTWARE DESIGN

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV: TESTING AND MAINTENANCE

Software testing Fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging –Software Implementation Techniques: Coding Practices-Refactoring-Maintenance and Reengineering-BPR Model-Reengineering Process Model-Reverse and Forward Engineering.

UNIT V: PROJECT MANAGEMENT

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS.

TEXTBOOKS

1. Roger S. Pressman, Software Engineering – A Practitioner‟s Approach, Ninth Edition, Mc Graw-Hill International Edition, 2020.
2. Ian Sommerville, Software Engineering, Tenth Edition, Pearson Education Asia, 2015.

REFERENCES

1. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, PHI Learning Private Limited, 2018.
2. Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010.

3. Kelkar S.A., Software Engineering, Third Edition, Prentice Hall of India Pvt Ltd, 2013.
4. Stephen R. Schach, Object-oriented Software Engineering, Tata McGraw-Hill Publishing Company Limited,2008.

WEB RESOURCES

1. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-355j-software-engineering-concepts-fall-2005/lecture-notes/
2. https://web.stanford.edu/class/archive/cs/cs295/cs295.1086/

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 305 L	Software Engineering Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

Week 1: Software Requirement Specification

1. Develop requirements specification for a given problem

Week 2: Data Flow Diagram (DFD)

2. Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem

Week 3: DFD and Structured chart

3. To perform the function-oriented diagram: DFD and Structured chart

Week 4: Use case Diagram

4. To perform the user's view analysis: Use case diagram

Week 5: Class Diagram

5. To draw the structural view diagram: Class diagram

Week 6: Object Diagram

6. To draw the structural view diagram: Class diagram, object diagram

Week 7: Package Diagram

7. To draw the structural view diagram: Package Diagram

Week 8: Sequence Diagram

8. To draw the structural view diagram: Sequence Diagram

Week 9: Interaction Overview Diagram

9. To draw the structural view diagram: Interaction Overview Diagram

Week 10: State-chart Diagram

10. To draw the behavioral view diagram: State-chart diagram

Week 11: Activity diagram

11. To draw the behavioral view diagram: Activity diagram

Week 12: Component diagram

12. To draw the implementation view diagram: Component diagram

Week 13: Deployment diagram

13. To draw the environmental view diagram: Deployment diagram

Week 14: Unit Testing

14. To perform various testing using the testing tool -unit testing

Week 15: Integration Testing

15. To perform various testing using the testing tool -integration testing

TEXTBOOKS

1. Roger S. Pressman, Software Engineering – A Practitioner‟s Approach, Ninth Edition, Mc Graw-Hill International Edition, 2020.
2. Ian Sommerville, Software Engineering, Tenth Edition, Pearson Education Asia, 2015.
3. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, PHI Learning Private Limited, 2018.
4. Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010.
5. Kelkar S.A., Software Engineering, Third Edition, Prentice Hall of India Pvt Ltd, 2013.
6. Stephen R. Schach, Object-oriented Software Engineering, Tata McGraw-Hill Publishing Company Limited,2008
7. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-355j-software-engineering-concepts-fall-2005/lecture-notes/
8. https://web.stanford.edu/class/archive/cs/cs295/cs295.1086/
9. Grady Booch, James Rumbaugh, Ivar Jacobson, Unified Modeling Language User Guide, The, 2nd Edition, 2016.
10. Dr.K.V.N.S. Prasad, "Software Testing Tools", 1st Edition, Dream tech, 2011.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 337	Cryptography	E	3	0	0	3

UNIT I

History and overview of cryptography, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, And Steganography.

UNIT II

Stream Ciphers and Block Ciphers, Attacks on block ciphers, Block Cipher Principles, The Data Encryption Standard (DES), Block Cipher Design Principles, Group, Rings, Field, Polynomial Arithmetic, The Euclidean Algorithm, Finite Fields of the Form GF(2^n).

UNIT III

Advanced Encryption Standard (AES), Stream Ciphers, RC4, The Chinese Remainder Theorem, Public Key Cryptography and RSA Algorithm, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography.

UNIT IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Secure Hash Algorithm (SHA), SHA-3.

UNIT V

Introduction to Block Chain, Bitcoin basics, Smart Contracts, Blockchain development platforms and APIs, Blockchain Ecosystems, Ethereum, Distributed Consensus, Blockchain Applications.

TEXTBOOKS/REFERENCES

1. Stallings, William. Cryptography and network security, Principle and Practice. Pearson Education India, 2017.
2. R. Stinson Cryptography, Theory and Practice (Fourth Edition Edition).
3. Handbook of Applied Cryptography by A. Menezes, P. Van Oorschot, S. Vanstone.
4. Melanie Swan, Blockchain, Blueprint for a new Economy, OReilly.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 337 L	Cryptography Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Write a program take text file as an input and print word, character count and ascii value of each characters as output. (Hint: Use open(), read() and split()).
2. Write a encryption program: Input: computerscienceengineeringsrmuniversity Output: gsqtyxivwgmirgiirkmriivmrkwvqyrmzivwmxc Hint: key =4 (play with ascii value).
3. Raju send an encrypted message (cipher text) "PHHW PH DIWHU WKH WRJD SDUWB" to Rani. Can you build decryption process and find out what is the message (plain text) send to Rani? Hint: try all keys.
4. Raju send encrypted message "ZICVTWQNGKZEIIGASXSTSLVVWLA" to Rani. Can you build decryption process and find out what is the message send to Rani. Hint: try all keys for each character.
5. Kohli have plain text "wewishtoreplaceplayer". Can you build encryption process and find out what is the cipher text he needs send to BCCI. Help him out by using monoalphabatic cipher. Hint: use any one-to-one mapping between alphabets.

   One to one mapping

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	N	D	R	E	W	I	C	K	S	O	H	T	B	F	G	J	L	M	P	Q	U	V	X	Y	Z

6. Kohli sent encrypted message (Cipher text) "SEEMSEAOMEDSAMHL" to Anushka. Can you build decryption process and find out what is the message (plain text) send to Anushka. Hint: use above one to one mapping between alphabets.
7. Raju want to build encrypted and decryption algorithms of Playfair Cipher. Help him to build a key matrix using the key "srmapuniversity"
8. By using key matrix Raju want to send message "we are discovered save yourself" to Rani. Can you build encryption process and find out what is the cipher text message send to Rani by using palyfaircipher.

s	r	m	a	p
u	n	i/j	v	e
t	y	b	c	d
f	g	h	k	l
o	q	w	x	z

9. By using key "CBDE" Raju would like send message (plain text)"HELLO WORLD" to Rani. Can you build encryption process and find out what is the encrypted message (cipher text) to Raju by using Hill Cipher.Also Can you build decryption process and find out what is the decrypted message (plain text) of cipher text "SLHZYATGZT" by using Hill Cipher.
10. Implementation of Encryption and Decryption of Vigenère Cipher

    keyword *deceptive*

    key: deceptivedeceptivedeceptive
    plaintext: wearediscoveredsaveyourself
    ciphertext: ZICVTWQNGRZGVTWAVZHCQYGLMGJ

11. Implement the Encryption and Decryption of Row Transposition.

    Key: 4 3 1 2 5 6 7
    Plaintext: a t t a c k p
    o s t p o n e
    d u n t i l t
    w o a m x y z
    Ciphertext: TTNAAPTMTSUOAODWCOIXKNLYPETZ
12. Implement the Euclidean Algorithm for integers and polynomials.
13. Implement AES Key Expansion.
14. Implementation of AES encryption and decryption
15. Implementation of Simplified DES Encryption and decryption
16. Implementation of RC4
17. Implementation of RSA algorithm
18. Implementation of Diffie-Helman key exchanges
19. Implementation of elliptic-curve cryptography
20. Implementation of Hash functions

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 315	Network Security	E	3	0	0	3

UNIT I: NEED FOR SECURITY

Need for Security: Security Attack, Security Services, Information Security, Methods of Protection.

Network Concepts: Basic Concepts of Computer Networks

Threats in Networks: Threat Precursors, Threats in Transit, Protocol Flaws, Message Confidentiality Threats, Nonexistent and Well-Known Authentication, Spoofing, DoS, DDoS

Network Security Controls: Segmentation, Redundancy, Single Points of Failure, Encryption, Link and End-to-End Encryption, Virtual Private Networks, VPN & Firewall, PKI and Certificates, SSL and SSH Encryption, Kerberos, Onion Routing

UNIT II: AUTHENTICATION

Message Authentication Codes (MAC): Message Authentication Requirements, Message Authentication Functions, Security of MACs, MACs Based on Hash Functions: HMAC.

Digital Signature: Digital Signatures, Elgamal Digital Signature Scheme, Schnorr Digital Signature Scheme, NIST Digital Signature Algorithm, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

Overview of Authentication Systems: Password-Based Authentication, Address-Based Authentication, Cryptographic Authentication Protocols, Trusted Intermediaries, KDCs, Certification Authorities (CAs), Session Key Establishment.

Security Handshake Pitfalls: Login, Mutual Authentication, Integrity/Encryption for Data, Two-Way Public Key Based Authentication, One-Way Public Key Based Authentication, Mediated Authentication (with KDC), Needham-Schroeder, Expanded Needham-Schroeder, Otway-Rees, Nonce Types.

Strong Password Protocols: Lamport's Hash, Strong Password Protocols, Strong Password Credentials Download Protocols.

UNIT III: IPSEC

IPSec: Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Comparison of Encodings.

Internet Key Exchange (IKE): Photuris, SKIP, History of IKE, IKE Phases, Phase 1 IKE - Aggressive Mode and Main Mode, Phase 2/Quick Mode, Traffic Selectors, The IKE Phase 1 Protocols, Phase-2 IKE: Setting up IPsec SAs, ISAKMP/IKE Encoding - Fixed Header, Payload Portion of ISAKMP Messages, SA Payload, SA Payload Fields.

UNIT IV: WEB SECURITY

Web Security Requirements: Web Security threats, Web traffic Security Approaches.

SSL/TLS: Secure Socket Layer (SSL), Transport Layer Security (TLS), TLS Architecture, TLS record protocol, change cipher spec protocol, Alert Protocol, Handshake Protocol, Https, SSH.

Secure Electronic Transaction (SET): SET functionalities, Dual Signature, Roles & Operations, Purchase Request Generation, Purchase Request Validation, Payment Authorization and Payment Capture.

SNMP: Basic concepts of SNMP, SNMP basic components and their functionalities, Basic commands of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats.

UNIT V: FIREWALL & EMAIL SECURITY

Firewalls: Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations.

Electronic Mail Security: Pretty Good Privacy, S/MIME, DNSSEC, Domain Keys Identified Mail.

TEXTBOOKS

1. Perlman, Radia, Charlie Kaufman, and Mike Speciner. Network security: private communication in a public world. Pearson Education India, 2016.
2. Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition.

REFERENCES

1. Network Security and Cryptography, Bernard Menezes, CENGAGE Learning.
2. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
3. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 315 L	Network Security Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Packet assembler/analyzer: Wireshark.
2. Packet assembler/analyzer: hPing3.
3. Encrypted communication over socket using AES.
4. Message Authentication Code: MAC.
5. MAC Based on Hash Function: HMAC.
6. Session Key establishment using RSA.
7. Handcraft a TCP handshake.
8. Diffie-Hellman Algorithm.
9. DH Key exchange.
10. Network Mapper: Nmap Basics.
11. Penetration Testing: Metasploit Basics.
12. Key tool & OpenSSL.
13. One Way SSL to a Web App.
14. SNMP: net SNMP – MIB.
15. Firewall with UFW.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 316	Distributed Systems	E	3	0	0	3

UNIT I: INTRODUCTION AND ARCHITECTURES

Introduction: Definition of a distributed system, Goals, types of distributed systems Architectures: Architecture styles, System architectures, Architectures versus middleware, Self-management in distributed systems.

UNIT II: PROCESSES AND COMMUNICATION

Processes: Threads, Virtualization, Clients, Servers, Code Migration. Communication: Fundamentals, Remote Procedure Call, Message and Stream oriented communication, Multicast communication.

UNIT III: NAMING AND SYNCHRONIZATION

Naming: Flat naming, Structured naming, Attribute-based naming. Synchronization: Clock synchronization, Logical clocks, Mutual exclusion, Election algorithms.

UNIT IV: CONSISTENCY AND REPLICATION

Replication as Scaling Technique, Data-Centric Consistency Models: Continuous Consistency, Data-Centric Consistency Models: Consistent Ordering of Operations, Data-Centric Consistency Models: Consistent Ordering Of Operations, Replica-Server Placement, Replica-Server Placement, Content Distribution, Continuous Consistency, Primary-Based Protocols, Replicated-Write Protocols, Cache-Coherence Protocols.

UNIT V: FAULT TOLERANCE AND SECUIRTY

Fault tolerance: Introduction, Process Resilience, Reliable client server communication, Reliable group communication, Distributed Commit, Recovery. Security: Secure channels, Access control, Security Management.

TEXTBOOKS/REFERENCES

1. Andrew S. Tanenbaul, Maarten Van Steen, Distributed Systems, Principles and Paradigms, Pearson publications, 2nd edition.
2. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
3. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
4. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.

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Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 316 L	Distributed Systems Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Experiment-1: Implement concurrent echo client-server application.
2. Experiment -2: Implement concurrent day-time client-server application.
3. Experiment-3: Configure following options on server socket and tests them: SO_KEEPALIVE, SO_LINGER, SO_SNDBUF, SO_RCVBUF, TCP_NODELAY
4. Experiment -4: Simulate the functioning of Lamport‟s Logical Clock in C.
5. Experiment -5: Simulate the Distributed Mutual Exclusion in C.
6. Experiment -6: Implement Java RMI‟ mechanism for accessing methods of remote systems.
7. Experiment -7: Simulate Balanced Sliding Window Protocol in C.
8. Experiment -8: Incrementing a counter in shared memory.
9. Experiment -9: Create CORBA based server-client application.
10. Experiment -10: Design XML Schema and XML instance document.
11. Experiment -11: SOAP based: Implement Arithmetic Service that implements add and subtract operations /Java based: Implement Trigonometric Service that implements sin, and cos operations.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 318	Cloud Computing	E	3	0	0	3

UNIT I

Distributed system models: Scalable computing over the internet, Technologies for network-based systems, System models and software environments for distributed and cloud computing, performance, security and Energy Efficiency Computer clusters for Scalable parallel computing: Clustering for Massive parallelism, Computer clusters and MPP Architectures, Design principles of computer clusters, Cluster job and resource management.

UNIT II

Virtual Machines and Virtualization of Data Centres: Implementation levels of virtualization, Virtualization structures, tools and mechanisms, Virtualization of CPU, Memory and I/O devices, Virtual clusters and resource management, Virtualization for Data center automation.

UNIT III: NAMING AND SYNCHRONIZATION

Cloud computing and service models, Data center design and interconnection networks, Architectural design of Compute and storage clouds, Public cloud platforms, Inter-cloud resource management, Cloud security and trust management.

UNIT IV: CONSISTENCY AND REPLICATION

Services and service-oriented architecture, Message oriented middleware, Portals and science gateways, Discovery, Registries, Meta data and databases. Workflow in service-oriented architectures,

UNIT V: FAULT TOLERANCE AND SECURITY

Features of cloud and Grid platforms, Parallel and distributed programming paradigms, Programming support for Google application engine, Programming on Amazon AWS and Microsoft Azure, Emerging cloud software environments.

TEXTBOOKS

1. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
2. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley.

REFERENCES

1. Distributed and Cloud Computing. Kal Hwang. Geoffeiy C. Fox. Jack J. Dongarra. Elsevier. 2012.
2. Cloud computing, Black book. Deven Shah, Kailash Jayaswal, Donald J. Houde, Jagannath Kallakurchi.
3. Cloud Computing: Concepts, Technology & Architecture (The Prentice Hall Service Technology Series from Thomas Erl) 1st Edition, Thomas Erl (Author), Ricardo Puttini , Zaigham Mahmood.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSE 318 L	Cloud Computing Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Basics of Virtualization: VMM, Example of VMM (virtualbox), Cretaion of a VM, Networking and communication between VMs.
2. Introduction to CloudSim: Installation and Execution, Cloud Datacenter, Network Topology.
3. Simulation of a Cloud Framework: Creating a DC, Creation of Tasks, Creation of VMs, Defining task and VM characteristics, execution of tasks on VMs.
4. Scalable and dynamic Cloud systems: Creation of scalable cloud entities, creation of dynamic entities.
5. Resource Allocation in Cloud Datacenter: Experimenting and understanding various resource allocation policies, Changing the resource allocation policy, effects of resource allocation policies.
6. Power Management in Cloud Datacenters: Creation of a power datacenter, understanding various power saving techniques.
7. Understanding Commercial Cloud Frameworks: Amazon AWS, Elastic Cloud, Amazon Load Balancer, creating VMs, Allocation of Resources.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 317	Embedded Systems	E	3	0	0	3

UNIT I: INTRODUCTION TO EMBEDDED SYSTEMS

Introduction, characteristics of embedding computing applications, concept of real time systems, designing of hardware and software components, challenges in embedded system design, Safety and Security of an Embedded System, Performance of Embedded Systems.

UNIT II: INSTRUCTION SET OF PROCESSORS

Overview of various features of Computer Architecture, Instruction-set of ARM family of processors, Instruction-set of PIC family of Processors, Digital Signal Processor, Instruction set of TI C55X DSP. Programmed I/O, Interrupts (supported by Arm, PIC , TI C55x family of processors), Supervisor mode, exceptions, traps, co-processors, memory system, CPU power management.

UNIT III: INPUT-OUTPUT SUB-SYSTEM

I/O sub-system: busy-wait I/O, DMA, interrupt driven I/O, co-processors and hardware accelerators, Timers and counters, watchdog timers, interrupt controllers, DMA controllers, A/D and D/A converters. Component interfacing, interfacing protocols, Firewire, USB, IrDA. Sensors and Actuators.

UNIT IV: PROGRAM DESIGN AND ANALYSIS

State machine, circular buffer, stream-oriented programming, data flow graph (DFG), control flow graph (CFG), Compilation techniques, performance analysis, performance optimization, power analysis and power optimization, program validation and testing.

UNIT V: OPERATING SYSTEMS

Basic features of an operating system, Kernel features, polled loops system, co-routines, interrupt-driven system, multi-rate system, processes and threads, context switching, scheduling, task assignment, inter-process communication, Real-time Memory Management: Process stack management, dynamic allocation, synchronous and asynchronous I/O, Interrupt handling, device drivers, example real-time OS: VxWorks, RT-Linux, PSOS.

TEXTBOOKS

1. Wolf, Marilyn. Computers as components: principles of embedded computing system design. Elsevier, 2017 (4^{th} Ed.).
2. Marwedel, Peter. Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems, and the Internet of Things. Springer, 2017. (3^{rd} Ed.)

REFERENCES

1. Manish Patel, The 8051 Microcontroller based Embedded System, McGraw Hill 2014 (1^{st} edn.).
2. Mall, Rajib. Real-time systems: theory and practice. Pearson Education India, 2009. (1^{st} edn

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 317 L	Embedded Systems Lab	E	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. Introduction to Software tool (preferably kiel MDK Microcontroller Development Kit) used in the lab. (2 hrs)
2. Interfacing of 8-bit ADC 0809 with 8051 Microcontroller. (1 hour)
3. Interfacing of 8-bit DAC 0800 with 8051 Microcontroller. (1 hour)
4. Implementation of Serial Communication by using 8051 serial ports. (1 hour)
5. Interfacing of individual LEDs and program them to blink after a fixed time interval. (1 hour)
6. Interfacing of 16*2 LCD panel with 8051 Microcontroller. (1 hour)
7. Interfacing of stepper motor with 8051 Microcontroller. (1 Hour)
8. A minor project is given to student to implement (7 hrs)

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 424	Deep Learning	E	3	0	0	3

UNIT I: INTRODUCTION

Overview of machine learning, linear classifiers, loss functions.

Introduction to Tensor Flow: Computational Graph, Key highlights, creating a Graph, Regression example, Gradient Descent, Tensor Board, Modularity, Sharing Variables, Keras.

UNIT II: Activation Functions

Sigmoid, ReLU, Hyperbolic Fns, Softmax Perceptrons: What is a Perceptron, XOR Gate.

Artificial Neural Networks: Introduction, Perceptron Training Rule, Gradient Descent Rule, vanishing gradient problem and solution.

UNIT-III: Convolutional Neural Networks

Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, problem, and solution of under fitting and over fitting.

UNIT IV: Recurrent Neural Networks

Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, GRU, Encoder Decoder architectures.

UNIT V: Deep Learning applications

Image segmentation, Self-Driving Cars, News Aggregation and Fraud News Detection Natural Language Processing, Virtual Assistants, Entertainment, Visual Recognition Fraud Detection, Healthcare.

TEXTBOOKS

1. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Josh Patterson, Adam Gibson, Deep Learning: A Practitioner's Approach, OReilly, 2017.
3. Gulli, Antonio, and Sujit Pal. Deep learning with Keras. Packt Publishing Ltd, 2017.
4. Buduma, Nikhil, and Nicholas Locascio. Fundamentals of deep learning: Designing next-generation machine intelligence algorithms. " O'Reilly Media, Inc.", 2017.

REFERENCES

1. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G., H., and Van Loan, C. F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 420	Data and Web Mining	E	3	0	0	3

UNIT I: INTRODUCTION TO DATA MINING

What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics. Data Mining Goals. Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods. Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model, OLAP operations .

UNIT II: DATA PRE-PROCESSING

Data cleaning. Data transformation, Data reduction. Data mining knowledge representation, Attribute-oriented analysis. Data mining algorithms: Association rules: Motivation and terminology, Basic idea: item sets, generating item sets and rules efficiently, Correlation analysis.

UNIT III: DATA MINING ALGORITHMS

Classification, Basic learning/mining tasks, inferring rudimentary rules: 1R algorithm, Decision trees, Covering rules. Data mining algorithms: Prediction, The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbour), Linear models.

UNIT IV: WEB CRAWLING

Basic crawler algorithm, Focused crawlers, Topical crawlers, Web search: Web page pre-processing, Inverted index, HITS algorithm, Page ranking algorithm, Leadership algorithm.

UNIT V: SOCIAL NETWORK ANALYSIS

Co-citation and bibliographic coupling, Community discovery. Web usage mining: Recommender systems. Mining Twitter, Mining Face book, Mining Instagram.

TEXTBOOKS/REFERENCES

1. Han, J., Kamber, M., & Pei, J. (2011). Data mining: Concepts and techniques (3rd ed.). Morgan Kaufmann publications.
2. Introduction to Data Mining, Vipin kumar, Michael Steinbach, Pang-Ning Tan, Person publications,2016
3. Mining the Web, Soumen Chakrabarti, Elseier publications, 2002
4. Web Data Mining, Bing Liu, Second Edition, Springer publications, 2011.
5. Mining the Social Web, Mathew A. Russel, Mikhail Klassen, Third edition, Oreily publications, 2018.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
CSC 323	Natural Language Processing	E	4	0	0	4

UNIT I: Introduction

Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues – Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.

UNIT II: Word Level and Syntactic Analysis

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

UNIT III: Semantic Analysis and Discourse Processing

Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT IV: Natural Language Generation and Machine Translation

Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation-Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

UNIT V: Information Retrieval and Lexical Resources

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame Net-Stemmers-POS Tagger- Research Corpora.

Text Books:

1. Daniel Jurafsky , James H. Martin , “Speech & language processing”, Pearson publications.
2. Allen, James. Natural language understanding. Pearson, 1995.

References:

1. Pierre M. Nugues, “An Introduction to Language Processing with Perl and Prolog” , Springer.

List of Allied Subjects

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
MAT 142	Single Variable Calculus	AC	4	0	0	4

UNIT I: DERIVATIVES AND DIFFERENTIATION

Limit, Continuity and limits of quotients, Derivatives and its geometrical Interpretation, Derivative as a function and calculating derivative, Leibnitz notation and higher derivatives, Trigonometric functions, Linear Approximations, Product and quotient rules, Chain rule, Implicit differentiation, Inverse, exponential and logarithm functions.

UNIT II: APPROXIMATIONS AND THEIR APPLICATIONS

Measurement error of linear approximation, Quadratic approximation, Newton's method, 1 and 2nd derivative test, Limits and asymptotic, Max min problems, Related application in real-life problems.

UNIT III: THE INTEGRAL AND INTEGRATION THEORY

Mean Value Theorem, Differentials and anti-derivatives, Differential equations, The definite integral, First and Second Fundamental Theorem of Calculus.

UNIT IV: DIFFERENT INTEGRATION TECHNIQUES AND APPLICATION OF CALCULUS

Areas and Volumes, Average value, Probability, Numerical Integration, Integrals of Trigonometric Power, Trigonometric substitution, Partial fractions, Integration by Parts, Arc length and Surface area.

UNIT V: POLAR CO-ORDINATE SYSTEMS AND INFINITE SERIES

Parametric curves, Polar co-ordinates, L'Hospital's rule, Improper Integrals, Infinite Series, Taylor's series.

TEXTBOOKS

1. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, Third edition, Wiley India , 2005.
2. S. R. Ghorpade and B. V. Limaye, An Introduction to Calculus and Real Analysis,
3. Michael Spivak, Calculus, Third Edition, Cambridge University, 2008.

REFERENCES

1. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 3rd Ed., Pearson Education India 9th Edition 1999
2. P.M. Fitzpatrick, Advanced Calculus, 2nd Edition, AMS Indian Edition, 2010.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
MAT 124	Multi-variable Calculus	AC	4	0	0	4

UNIT I

Vector and Matrices

Vectors, Dot product, Determinants; cross product, Matrices; inverse matrices, Square systems; equations of planes, Parametric equations for lines and curves, Velocity, acceleration, Kepler's second law

UNIT II

Partial Derivatives

Level curves; partial derivatives; tangent plane approximation, Max-min problems; least squares, Second derivative test; boundaries and infinity, Differentials; chain rule, Gradient; directional derivative; tangent plane, Lagrange multipliers,Non-independent variables, Partial differential equations

UNIT III

Double integral and line integrals in the plane

Double integrals, Double integrals in polar coordinates; applications, Change of variables, Vector fields and line integrals in the plane, Path independence and conservative fields,Gradient fields and potential functions, Green's theorem, Flux; normal form of Green's theorem, Simply connected regions

Unit IV

Triple integrals in 3D

Triple integrals in rectangular and cylindrical coordinates, Spherical coordinates; surface area, Vector fields in 3D; surface integrals and flux, Divergence theorem: applications and proof.

Unit V

Surface integral in 3D

Line integrals in space, curl, exactness and potentials, Stokes' theorem, Topological considerations, Maxwell's equations.

TEXTBOOKS

1. Edwards, Henry C., and David E. Penney. Multivariable Calculus. 6th ed. Lebanon, IN: Prentice Hall, 2002.
2. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 9th Edn., Pearson Education India, 1996.

Reference Book

1. T. M. Apostol, Calculus - Vol.2, 2nd Edn., Wiley India, 2003.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
MAT 302	Numerical Analysis	AC	4	0	0	4

UNIT I: EQUATION FORMS IN PROCESS MODELING

Linear and Nonlinear Algebraic Equation, Optimization based Formulations, ODE-IVPs and Differential Algebraic
Equations, ODE-BVPs and PDEs , ODE-BVPs and PDEs, Abstract model forms.

UNIT II: FUNDAMENTALS OF VECTOR SPACES

Generalized concepts of vector space, sub-space, linear dependence, Concept of basis, dimension, norms defined on general vector spaces, Examples of norms defined on different vector spaces, Cauchy sequence and convergence, introduction to concept of completeness and Banach spaces, Inner product in a general vector space, Inner-product spaces and their examples, Cauchy-Schwartz inequality and orthogonal sets.

UNIT III: PROBLEM DISCRETIZATION USING APPROXIMATION THEORY

Transformations and unified view of problems through the concept of transformations, classification of problems in numerical analysis, Problem discretization using approximation theory, Weierstrass theorem and polynomial approximations, Taylor series approximation

UNIT IV: SOLVING LINEAR ALGEBRAIC EQUATIONS

Classification of solution approaches as direct and iterative, review of Gaussian elimination, Introduction to methods for solving sparse linear systems: Thomas algorithm for tridiagonal and block tridiagonal matrices, Block-diagonal, triangular and block-triangular systems, solution by matrix decomposition.

UNIT V: SOLVING ORDINARY DIFFERENTIAL EQUATIONS – INITIAL VALUE PROBLEMS (ODE-IVPS)

Introduction, Existence of Solutions, Analytical Solutions of Linear ODE-IVPs, Analytical Solutions of Linear ODE-IVPs (contd.), Basic concepts in numerical solutions of ODE-IVP: step size and marching, concept of implicit and explicit methods.

** Apart from the regular lectures, the allotted lecture hours can be used for tutorial and problem solving sessions.

TEXTBOOKS

1. Richard L. Burden, J. Douglas Faires, Numerical analysis, 3 ed. - Boston : Prindle, Weber & Schmidt, 1985.
2. Philips, G. M.,Taylor,P. J. ; Theory and Applications of Numerical Analysis (2nd Ed.), Academic Press, 1996.

REFERENCES

1. Gourdin,A. and M Boumhrat;Applied Numerical Methods.Prentice Hall India, New Delhi,(2000).

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
MAT 303	Number Theory	AC	4	0	0	4

UNIT I

Primes, Divisibility and the Fundamental Theorem of Arithmetic Introduction, Diophantine Equations, Divisibility, GCD

UNIT II

Greatest Common Divisor (GCD), Euclidean Algorithm Euclidean Algorithm, Primes, Binomial Coefficients

UNIT III

Congruences, Chinese Remainder Theorem, Hensel's Lemma, Primitive Roots
Congruences, Fermat, Euler, Wilson, Linear Congruences, Chinese Remainder Theorem, Algorithms, Primality, Factoring, RSA, Hensel's Lemma, Congruences mod Primes, Order, Primitive Roots, Index Calculus

Unit IV

Quadratic Residues and Reciprocity Quadratic Residues, Quadratic Reciprocity, Jacobi Symbol, Computation, Zolotareff's Definition, Square Roots, Tonelli's Algorithm, Number of Consecutive Pairs of Squares mod p, Cyclotomic Polynomials, Primes Congruent to 1 mod n, Arithmetic Functions, Mobius Inversion Formula, Zeta Functions, Li Recurrences

UNIT V

Arithmetic Functions, Diophantine Equations, Continued Fractions
Generating Functions, More on Generating Functions, Two Squares Theorem, Continued Fractions, Quadratic Irrationalities, Brahmagupta-Pell Equation, Four Squares Theorem, Pythagorean Triples, Fermat Descent, Rational Points on Conics

** Apart from the regular lectures, the allotted lecture hours can be used for tutorial and problem solving sessions.

TEXTBOOKS

1. David M. Burton: Elementary Number Theory (McGraw-Hill Higher Education, International Edition)
2. G. H. Hardy, Edward M. Wright, Andrew Wiles. An Introduction to the Theory of Numbers. 6th Edition.

REFERENCES

1. David Burton. Elementary Number Theory. 7th Edition

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
MAT 154	Differential Equations	AC	4	0	0	4

UNIT I: FIRST ORDER DIFFERENTIAL EQUATIONS

Geometric meaning of $y' = f(x, y)$, Direction Fields, Euler's Method, Classification of ODEs (Linear, Non-linear, Exact, Separable), Integrating Factor, Bernoulli Equations, Initial Value Problem, Modelling (Free falling object, Radioactivity, RL-circuit).

UNIT II: SECOND AND HIGHER ORDER LINEAR ODES

Homogeneous Linear ODEs, Modelling of Free Oscillations of a Mass-Spring System, Euler-Cauchy Equations, Non-homogeneous ODEs, Variation of Parameters, Modelling (Forced Oscillations, Electric Circuits).

UNIT III: SYSTEM OF ODES

Modelling Engineering problems (Electric Network, Mixing problem in two tanks etc.) as systems of ODEs, Wronskian, Phase-Plane Method, Critical Points & Stability, Qualitative Methods for Nonlinear Systems, Nonhomogeneous Linear Systems of ODEs.

UNIT IV: SERIES SOLUTIONS OF ODES

Introduction to power series method, Legendre's equation & polynomials, Frobenius Method, Bessel's Equations & Functions.

UNIT V: LAPLACE TRANSFORMS

Laplace transforms of standard functions, Shifting Theorems, Transforms of derivatives and integrals, Unit step function, Dirac's delta function, Inverse Laplace transforms, Convolution theorem (without proof). Application: Solutions of ordinary differential equations using Laplace transforms.

TEXTBOOKS

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

REFERENCES

1. Mary L. Boas, Mathematical Methods in Physical Sciences, 3rd Edition, Wiley-India.
2. G. F. Simmons, Differential Equation with Applications and Historical Notes, TATA McGraw Hill.
3. S. Vaidyanathan, Advanced Applicable Engineering Mathematics, CBS Publishers.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
MAT 151	Linear Algebra	DC	4	0	0	4

UNIT I: Vector Space

Revision of the basic theory of vector space over arbitrary field, Examples of vector spaces, direct sum of vector spaces, Dual of a vector space, Basis and dimension, examples of infinite dimensional vector space, computing with bases.

UNIT II: Matrix and determinants

Elementary matrix theory revisited. Definitions of Symmetric, Hermitian , skew symmetric and skew Hermitian matrix, orthogonal and Unitary matrix, properties of determinants.

UNIT III: Linear Transformation

Matrices as a linear transformation, Matrix of a linear transformation, Kernel and Image of a linear map, rank and nullity theorem, application of rank nullity theorem, diagonalizability.

UNIT IV: Geometry and application of linear transformation

Orthogonal linear transformation and rotation, eigen values and eigen vectors of a linear transformation, Eigen subspace, Diagonalizability criteria of a linear map in terms of director sum decomposition of the vector space as eigen subspaces, the system of differential equations, the matrix exponential.

UNIT V: Advanced linear algebra

Bilinear forms, symmetric and Hermitian bilinear forms, Euclidian spaces and Hermitian spaces, Spectral theorem , conics and quadrics, skew Hermitian forms.

Books of Study & References:

1. G. Strang, Linear Algebra and Its applications, Nelson Engineering, 4th Edn., 2007
2. K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall of India, 1996
3. S. Axler, Linear Algebra Done Right, 2nd Edn., UTM, Springer, Indian edition, 2010
4. G. Schay, Introduction to Linear Algebra, Narosa, 1997.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
PHY 204	Physics I	AC	3	0	0	3

UNIT I - Review of Newtonian Mechanics

Review of Scalars, Vectors, Kinematics: Equations of motion for constant acceleration and non-constant acceleration Dynamics: Contact forces, Static friction, kinetic friction and worked examples, Free body force diagram; Applications of Newton's law. Worked examples Tension, Pulley systems, worked examples, Solving various pulley systems using free body force diagram and Newton's law

Momentum and Impulse, Impulse momentum theorem, Average force, worked examples Conservation of Momentum, Momentum Diagrams, Worked examples Center of Mass of point objects and continuous systems e.g., rod, rectangular sheet Center of Mass of a Uniform and different objects

Motion of the Center of Mass; Velocity and Acceleration of the Center of Mass, Reduction of a System to a Point Particle, Center of Mass Trajectory, projectile blast problem

UNIT II – Work and Energy

Kinetic Energy and Work in 1D, 2D and 3D; Work by a Constant and a non- Constant Force Work-Kinetic Energy Theorem and worked examples, Conservative and Non-Conservative Forces with examples, Potential Energy due to gravity and Potential Energy of a spring Principle of energy conservation; worked examples. Collision and its type. Collision in 1D and 2D; Rigid body, Rotational Motion, moment of inertia Moment of inertia of various objects, worked examples, Parallel and perpendicular axis theorem, Torque and Angular momentum, conservation of angular momentum, worked examples Rolling motion, worked examples, Conservation of energy in rotational motion

UNIT III – HEAT & HERMODYNAMICS

Basic Thermodynamics – Concept of Temperature, First and Second Law(s) applicable to Heat Engines and Refrigerators; Thermodynamic Process-Isothermal, Adiabatic, Isobaric, Isochoric, Adiabatic relations of system for perfect gas Pressure-Volume and Temperature-Entropy Diagrams for engines Conversion of Heat into Work and its converse, Carnot's Cycle and Carnot's Heat Engine and its efficiency Otto cycle, Diesel cycle and its comparison, efficiencies, The Carnot Refrigerator

Maxwell–Boltzmann Distribution, Equipartition theorem Seebeck, Peltier and Thomson effect, Thermoelectric generators and its applications, Thermocouples, Temperature measurement, Thermoelectric materials

UNIT IV: ELECTROSTATICS

Coordinate system, Cartesian, Cylindrical and Spherical Polar Gradient, divergence and curl Properties of charge and Coulomb's law Gauss's law and its applications

Electric potential and potential energy, examples Capacitors, parallel plate, cylindrical and spherical

Introduction to Electric Dipole and dipole Moment Torque and potential energy of a dipole Potential and field due to electric dipole

UNIT V: MAGNETISM

Magnetic force and cyclotron Biot-Savart Law for magnetic fields Magnetic field due to various current loops Motion of a current carrying coil in magnetic field and torque Ampere's circutal law

Introduction to time-varying fields Faraday's law of induction Lenz law and electro-motive force

Maxwell's equations in free space

TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

1. Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited))
2. Introduction to Electrodynamics –David J. Griffiths; 4th Edition, 2012, PHI Eastern Economy Editions

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
PHY 204L	Physics I Lab	AC	0	0	2	1

Description of Experiments:

1. Revisions of Vernier caliper and Screw Gauge
2. Plotting graphs and Error analysis
3. Determine moment of inertia of a flywheel
4. Determination of spring constant
5. Determination of thermal conductivity of a given material
6. Measurement of specific heat capacity of any given material
7. To find the dielectric constant of the medium using parallel plate capacitor
8. Use Faraday's law for finding the total magnetic flux through the coil
9. Verify the Biot-Savart law for a given circular coil

TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

1. Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited))

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
PHY 214	Physics II	AC	3	0	0	3

UNIT I - Introduction to Modern Physics

Electromagnetic waves; coupled magnetic and electric oscillations Introduction to special theory of relativity Inertial and non-inertial frames of reference Length contraction and time dilation Mass energy relation Quantum states of an electron in an atom, Introduction Atomic Spectra Early models of H-atoms Spectrum of Hydrogen Photoelectric effect and Compton scattering

UNIT II – Origin of Quantum Mechanics

Limitation of classical mechanics, Review of Black body radiation, examples Wave particle duality Matter waves - De Broglie hypothesis, Photoelectric effect, Linear Vector Space, Hilbert Space Heisenberg's uncertainty principle, Postulates of quantum mechanics – Schrödinger Wave function and its physical interpretation, Position, Momentum operator, angular momentum operator, and total energy operator, Orthogonality, Orth normality, Operator Schrödinger time dependent and independent equation, Schrödinger Representation, Heisenberg Representation, Interaction Representation

UNIT III – Application of Quantum Mechanics

Equation of continuity, and its physical significance Bound State, Free particle, Particle in infinitely deep potential well (one - dimension) Particle in three-dimension rigid box Scattering State Step potential, Potential barrier. (Qualitative discussion), Angular Momentum Generalized Angular Momentum Spin Momentum Qualitative discussion on the radial and angular parts of the bound state energy

UNIT IV: Introduction to Solid State Physics

Crystalline and amorphous solids, Lattice, Basis, Translational vectors, Primitive and non-primitive unit cell Symmetry operations, Different types of lattices-2D and 3D (Bravais lattices), Miller indices

SC, BCC and FCC structures, Packing fraction Various types of crystal structures Crystal structures- NaCl, diamond, CsCl, ZnS, HCP Concept of reciprocal lattice and its properties Ionic, covalent, molecular and metallic binding in crystalline solids Bragg's law and Bragg's Diffraction condition in direct and reciprocal lattice, Ewald's construction, Debye Schrrerer method

UNIT V: Solid State Devices

Classification of solids based on band theory Semiconductors - origin of band gap Intrinsic and extrinsic semiconductors, *p* and *n* type, and p-n junction diodes Transistors and its characteristics Different types of transistors and their uses Examples of various transistors and applications Energy storage devices, Supercapacitors, fuel cells. Photodetectors, transducers and sensors; applications, Solar Cells

TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

1. Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited))
2. Introduction to Solid State Physics – C Kittel; Eighth Edition, Wiley publishers
3. Concepts of Modern Physics (2017)- Arthur Besier, Shobhit Mahajan, S. Rai Choudhury (Tata McGraw Hill)

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
PHY 214L	Physics II Lab	AC	0	0	2	1

Description of Experiments:

1. Determine velocity of sound
2. Verification of Stefan`s Law
3. Characteristics of a p-n junction
4. Study the various Transistor Biasing configurations and CE Characteristics, load line and Q-factor
5. Characteristics of a Solar cell
6. Determine charge carrier type and concentration of a given semiconductor using Hall Effect
7. Study spectral lines from Neon using a Neon discharge lamp and determine the Rydberg constant using the Bohr model formulation
8. Determine lattice parameter of a given crystalline powder using X-ray diffractometer

TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

1. Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited))

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
BBA 304	Human Resource Management	AC	4	0	0	4

UNIT I

Introduction to Human Resource Management Meaning, Function, Significance & Challenges of HRM, HR Policies, Introduction to Human Resource Planning, Various Methods of HRP, Forecasting and HR Effectiveness – Case Study Analysis

UNIT II

Recruiting, Selecting & Socializing Introduction, Recruitment Policy, Issues, sources of people, selection process & tests, Socialization, Internal Mobility, Career Planning – Case Study Analysis

UNIT III

Training & Developing Workforce and Organizational Development Concept, need, method, importance & evaluation of training & development; principle of learning; Introduction to and Interventions in OD – Case Study Analysis

UNIT IV

Performance and Compensation Management System Definition, importance, objectives, components and methods of performance management system, Principal compensation issue, job evaluation, pay-structure, individual & group incentives – Case Study Analysis

UNIT V

Social Security and Labour Welfare Concept of Social Security and Industrial Relations, Workers Participation in Management Significance and various social security legislations in India – Case Study Analysis

TEXTBOOKS

1. "Managing Human Resources" by Bohlander and Snell Thomson Publications, "Human Resource Management" Gary Dessler and Biju Varkkey Pearson Publications

REFERENCES

1. Human Resource Management, Gary Dessler, Pearson Education
2. Human Resource Management, Casio Jaico Publishing House
3. Human Resource Management, Ivancevich McGraw Hill
4. The Management of People at Work Dale S.Beach Tata McGraw-Hill
5. Personnel Management, CB Memoria, Himalaya Publishing House
6. Human Resource Management Mizra S.Saiyadain Tata McGraw Hill
7. Human Resource Management ,VSP Rao Excell Books
8. Human Resource Management , P.Subba Rao,Himalaya Publishers

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
BBA H01	Leadership Diversity and Team Management	AC	4	0	0	4

UNIT I

Leadership – basic definition of the concept and components of leadership. Trait approach in theories of leadership (development and the present situation). Personal characteristics that support effective leadership. Leader and values. The significance of self-knowledge for the role of leader (identity and integrity of leader) - Motivation in the context of personality - sources of motivation - Motivation and performance, performance motivation, aspirations, work satisfaction - Specific theories of motivation, stimulation tools, motivation program in organization - motions and self-management, emotional intelligence and its significance in the role of leader. Handling emotions and stress. Personal risk of leader: personal traits endangering effective leadership.

UNIT II

Significance of communication skills for work life and leadership - Social perception in organization- Competency and behavior approaches to leadership. Model of four competencies for leadership. The contingency theory of leadership; situational leadership - Transactional and transformational leadership. Models of wellbalanced and authentic leadership - Leader and his or her followers. Models of relation between leadership and followership. LMX theory.

UNIT III

Leadership of workgroups and teams. Group structure and dynamics - Individual in a group. Formation of teams and team work. Group problem-solving. Team excellence. Participative leadership.

UNIT IV

Leadership development. Skills for leadership and performance management: Goal setting, support of employee development and communication of feedback; delegation; solving of conflict situations and negotiation. Tools for analysis of leadership styles and 360-degree feedback. Couching and mentoring.

UNIT V

Creative leadership. Influence on the creative potential of work groups and teams; formation of innovative climate in organizations - Leadership and power. Sources of power in organizations. Micropolitics, its strategy and tactics - Gender and leadership - Leadership and organization culture. Link between leadership and activities leading to the formation, assertion or changes in organization culture - Intercultural aspects of leadership. Differences in the accentuation of various aspects of leadership in the context of national cultures.

REFERENCES

1. DUBRIN, A J. Principles of leadership [Mason] SouthWestern/Cengage Learning.
2. ACHUA, C F. – LUSSIER, R N. Effective leadership [Mason] SouthWestern/Cengage Learning.
3. KOUZES, J. M., POSNER, B. Z. Learning Leadership. The Five Fundamentals of Becoming an Exemplary Leader. Wiley.
4. YUKL, G. Leadership in Organizations. Eighth Edition. Pearson Education.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
HIS102A	Human Civilizations	AC	4	0	0	4

UNIT I: EARLY HUMAN EVOLUTION

What is Civilisation? Stages of Human evolution, African Origins of Humanity, Sexual Dimorphism, Development of Language, Patterns of Lithic Technological Development, Hunter –Gathering Society; its social and economic structure

UNIT II: TOWARDS THE NEOLITHIC

Climate change and end of Ice Age, Towards the Mesolithic period and extension of settlement in new ecological zones, Changes in subsistence strategies based on the case studies from West Asia, Europe or Meso America, Shifts in tool manufacture and social organization from the Mesolithic to the Neolithic, Neolithic Period: Origins of food production, Gender Division of Labour; Case studies of early farming settlements at Catal Hoyuk, Abu Hureya, Jericho, Syria or Jordan. Early farming societies in Europe, Asia and the Nile Valley. Art and Architecture at Neolithic Sites; A study of cave paintings. Neolithic religious formations – burial customs and beliefs

UNIT III: BRONZE AGE SOCIAL FORMATIONS

Discovery of metals and its impact, Development of writing systems, Tigris and Euphrates river valley: Emergence of Cities, Urban Revolution: Ancient Egyptian Civilisation, Private life in ancient Egypt, Minoan Civilisation of Crete, Eastern Mediterranean World in the Ancient Period, Harappan Civilisation, Origin of Chinese Civilisation

UNIT IV: OTHER WAYS OF LIVING

Nomadic Pastoralism, Pastoral People of the Middle East, Pastoralism in Central Asia, Socio-political interaction of pastoral tribes with the urban centres, The advent of Iron - its origin and implications.

UNIT V: THE HELLENIC WORLD

Ancient Greece; the emergence of polis, Athens and Sparta, the Myth of Arcadia, The Slave Mode of Production: Emergence of Slavery in ancient Greece, Organization of production in Ancient Greece

The Nature of classical urbanism, Private life in ancient Greece, Hellenistic Phase: Characteristic features of Hellenism, Art and Culture in the Hellenic World

TEXTBOOKS/REFERENCE BOOKS

1. Bogucki, P. The Origins of Human Society. Massachusets and Oxford: Wiley Blackwell Publishers,1999
2. Amar Farooqui. Early Social Formations. Delhi: Manak Publications, 2001.
3. Fernand Braudel, The Mediterranean in the Ancient World, Penguin, 2007.
4. R.J Wenke Pattern in Prehistory: Humankind's First Three Million Years, Oxford University Press, 2006.
5. Redman, C.L. The Rise of Civilisations. From Early Farmers to Urban Society in the Ancient Near East. San Fransisco: W.H. Freeeman 1978.
6. V. Gordon Childe, What Happened in History, 1942.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
HIS 301	European Social Formations	AC	4	0	0	4

UNIT I: TRANSITION FROM FEUDALISM TO CAPITALISM

Empires in the East; The Ottomans, The Mughals, The Mings, Political Economy (Trade, Commerce and Agrarian System), Geographical expansion of the world through voyages and discoveries

Slave trade and gold rush, Mercantilism and its impact on Feudal Europe; The Dobb-Sweezy debate on Transition, Black Death

UNIT II: THE CHURNING OF THE CATHOLIC CHURCH

Renaissance and Reformation in Europe, Martin Luther and Reformation, Spread of Lutheranism

John Calvin and the doctrine of predestination, Spread of Calvinist thought The advent of the Printing Press, The coming of book in history, The Novel and the revolutionary impact on the printing press

UNIT III: THE SCIENTIFIC REVOLUTION

Reshaping Cosmology; Copernicus, Tycho Brahe, Johannes Kepler, Galileo, Newton The age of Discoveries; Columbus, Vasco da Gama et.al., Inventions; the Spinning jenny, the Flying Shuttle et.al., Steam engine and the transport revolution

UNIT IV: THE RISE OF ENGLAND AS AN INDUSTRIAL ECONOMY

Primitive Accumulation of Capital, The Enclosure Movement, The Putting Out System to the Factories, The Triangular Trade and the Empire of Cotton

UNIT V: INDUSTRIAL CAPITALISM TO FINANCE CAPITALISM

Capitalism and Colonialism: Economic Divergence, European and Asian economies before divergence, The divergence of Britain, causes for the great economic divergence, Emergence of France and Germany as colonial powers, Colonisation of the Americas, the Africas and Asia.

TEXTBOOKS/REFERENCES

1. Fernand Braudel, Afterthoughts on Material Civilization and Capitalism, The John Hopkins University Press, 1977
2. Fernand Braudel, Civilization and Capitalism, 15th to 18th Century, 3 Volumes, Harper & Row, New York, 1982-84.
3. Harbans Mukhia, The Mughals of India (Peoples of Asia), Wiley-Blackwell, 2004.
4. Immanuel Wallerstein, The Modern World System: Capitalist Agriculture and the Origins of the European World Economy in the Sixteenth Century, Volume 1, 1974.
5. Prasannan Parthasarathi, Why Europe Grew Rich and Asia Did Not: Global Economic Divergence, 1600-1850, 2011.
6. Quentin Skinner, The Foundations of Modern Political Thought: The Age of Reformation, Volume II, 1978.
7. Robert B. Marks, The Origins of the Modern World: A Global and Ecological Narrative, Rowman & Littlefield Publishers, 2002.

8. Thomas Kuhn, The Copernican Revolution: Planetary Astronomy in the Development of Western Thought, 1957.
9. Sanjay Subrahmanyam, Explorations in Connected History: Mughals and Franks, Oxford University Press, 2005.

Foundation Courses

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
PSY 111	Psychology for Everyday Living	FC	4	0	0	4

UNIT I: MYTHS AND MISCONCEPTIONS IN PSYCHOLOGY

Definition, nature and goals of psychology, Common myths and misconceptions about psychology Schools of psychology; Basic and applied areas of psychology

UNIT II: THE ROLE OF PERCEPTION AND ATTITUDE TOWARDS UNDERSTANDING THE WORLD

Perception: Understanding perception, Gestalt laws of organization, common illusions, Perceptual constancy - depth perception, size perception, perception of movement, Attitude formation, Attitude change

UNIT III: INTELLIGENCE AND LEARNING

Definitions and nature of intelligence, Emotional and social intelligence; Measuring IQ, EQ and SQ, Fundamentals of learning and its applications, Memory techniques.

UNIT IV: UNDERSTANDING THE SELF

Definition; Approaches to personality – trait and type, Psychoanalytical and humanistic theory, Tests of personality – MBTI and NEO-PI, Identity; Self-concept, self-esteem and self-efficacy.

UNIT V: STRESS, COPING AND QUALITY OF LIFE

Nature, sources of stress and its reactions, Factors influencing stress, coping with and managing stress - cognitive and behavioural techniques, Improving quality of life.

TEXTBOOKS

2. Baron, R. A. (2001). Psychology. New Delhi: Pearson Education India.

REFERENCES

3. Nolen-Hoeksema, S., Fredrickson, B.L. & Loftus, G.R. (2014). Atkinson & Hilgard's Introduction to Psychology.16th Ed. United Kingdom: Cengage Learning.
4. Nolen-Hoeksema, S., Fredrickson, B.L. & Loftus, G.R. (2014). Atkinson & Hilgard's Introduction to Psychology.16th Ed. United Kingdom: Cengage Learning.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
EGL 100	Introduction to Communicative English	FC	4	0	0	4

UNIT I
Course Introduction and Overview, Tenses, Principles of Sentence Structure& Paragraph Writing(*S+V+O*)

UNIT II
The Fundamentals of Speech (*Ethos, Pathos & Logos*) Verbal & Nonverbal Communication, Fundamentals of Personal, Informative, and Scientific Speech.

UNIT III
Listening Skills: Definition, Barriers, steps to Overcome. Listening to Influence, Negotiate, Note taking & Making while Listening.

UNIT IV
Read to Skim, and Scan, Read to Comprehend (Predict, Answer Questions & Summarize). Read to Understand.

UNIT V
Write to Inform - I News, Emails. Write to Inform- II Notice, Agenda & Minutes. Write to Define (Definitions & Essays).

TEXTBOOKS/REFERENCES

5. Shoba, Lourdes. (2017). Communicative English: A Workbook. U.K: Cambridge University Press.
6. Steven, Susan, Diana. (2015). Communication: Principles for a Lifetime. U.S.A: Pearson 6th Ed.
7. Publication Manual of the American Psychological Association, (2010). 6th Ed.
8. Kosslyn, S.M. "Understanding Charts and Graphs", Applied Cognitive Psychology, vol. 3, pp. 185-226, 1989.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
ENV 100	Introduction to Environmental Science	FC	4	0	0	4

UNIT I: INTRODUCTION TO ENVIRONMENTAL SCIENCE

Ecosystem structure and function, Ecological systems and major biomes, Water and nutrient cycles - Water cycle, phosphorous cycle, nitrogen cycle, Natural resources: renewable and non-renewable resources, forests, water, minerals, food and land; Energy sources, growing energy demands. Case study – Cape Town water crisis.

UNIT II: BIODIVERSITY AND ITS CONSERVATION

Biodiversity hotspots; Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; threats to biodiversity – habitat loss, poaching of wildlife; in-situ and ex-situ conservation. Case Study-The Last White Rhino, GMO, animal testing.

UNIT III: ENVIRONMENTAL POLLUTION AND ITS ROLE ON GLOBAL CLIMATE CHANGE AND HUMAN HEALTH

Structure and composition of atmosphere. Pollution – air, water, soil, thermal and radiation. Effects – acid rain, ozone layer depletion and greenhouse gas emission, Carbon cycle, Control measures. Water and air quality – Dissolved Oxygen, Biochemical Oxygen Demand (BOD), Air Quality Index (AQI). Air Pollution and Infant Mortality, Pollution case studies, Exxon Valdez Oil spill. Two field trips.

UNIT IV: ENVIRONMENTAL BIOTECHNOLOGY

Environmental microbiology; Biomarkers; Biosensors; Biofuels; Biotransformation; Bioremediation, factors affecting bioremediation; Molecular Ecology. One field trip.

UNIT V: ENVIRONMENTAL PROTECTION, SUSTAINABILITY, AND THE ROLE FOR POLICY

The tragedy of commons, Problems related to urban living, population explosion, waste management, sustainable solutions, role of regulation and taxes in environmental protection, the willingness to pay for clean air, environmental movements, and environmental protection acts in India and environmental ethics. Case study- Chinese Environmental Protection Tax, Water resource tax, CNG vehicles in Delhi/Delhi odd-or-even rule. Two field trips.

TEXTBOOKS

1. Basu. M, Xavier. S. “Fundamentals of Environmental Studies”, 1st edition, Cambridge University Press, 2016.
2. Raina. M. Maier, Ian L. Pepper, Charles. P. “Environmental Microbiology” 2nd edition, Academic Press, 2004.

REFERENCES

2. Danial. D. C. “Environmental Science”, 8th edition, Jones and Barlett Publishers, MA, 2010.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
MAT 221	Probability and Statistics for Engineers	FC	3	1	0	4

UNIT I: INTRODUCTION TO PROBABILITY

Introduction, counting and set, terminologies and examples, conditional probability, independence and Bayes' theorem.

UNIT II: PARTIAL DERIVATIVES

Discrete random variables, variance of discrete random variables, continuous random variables, Expectation, variance and standard deviation of continuous random variables, central limit theorem and law of large numbers, joint distributions and independence, covariance and correlation.

UNIT III: BAYESIAN INFERENCE

Introduction to statistics, Maximum likelihood estimate, Bayesian updating: discrete priors, probabilistic prediction, odds, continuous priors; Beta distribution, conjugate priors, probability intervals.

UNIT IV: NULL HYPOTHESIS SIGNIFICANCE TESTING

The frequentist school of statistics, Null hypothesis significant testing, comparison between frequentist and Bayesian inference

UNIT V: CONFIDENCE INTERVALS AND REGRESSIONS

Confidence intervals: normal data, three views, mean of the non-normal data; Bootstrap confidence intervals, linear regression.

TEXTBOOKS

1. J. Jacod and P. Protter, Probability Essentials, Springer, 2004.
2. K. S. Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications, Wiley India, 2008.

REFERENCES

2. S. Ross, A First Course in Probability, 6th Edn., Pearson, 2002.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
EGL 125	Critical Thinking	FC	4	0	0	4

UNIT I
Analyzing Problems, Science of Learning, Logical Thinking

UNIT II
Analyzing Decisions, Applying logic

UNIT III
Evaluating Claims and Justifications, Fallacy Detection, Understanding Bias, Mitigating Bias

UNIT IV
Evaluate and Use Strategies, Identifying the Right Problem and Sub problems, Gaps and Constraints

UNIT V
Solving Problems, Using Analogies in Problem Solving, Innovative Thinking

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
HIS 100	Idea of India	FC	4	0	0	4

UNIT I: THE NATION AND ITS MANY ROOTS

What is a Nation? –Theories of Nationalism, The many names of India: India, Hindia, Aryavarta Or Bharat, Mother India: Iconising a Nation

UNIT II: UNEARTHING THE PAST

The Evolutionary Past: Interbreeding Vs Replacement Theory, Out of Africa Theory, What is a civilization? Theories of Civilization, Indus Valley Civilization

UNIT III: STORIES OF GODS AND PEOPLE

The Emergence of Myths, Myth Vs Reality, Vedic Age in India, Tribes, Caste and Battles.

UNIT IV: POLITY AND GOVERNANCE

Religion, Economy and the State –Asoka, Chankya and the Buddha, Land the Economy: Exploring the Arthasastra, Social Order and the State: Through the Epics, Two millennia of pluralism: Jews, Christians and other religions in India.

UNIT V: TOWARDS UNDERSTANDING THE NATION

The Mughals in India, Multiple Identities – the same heritage, The Past as a Signifier

TEXTBOOKS

1. Y. N.Harari, A Brief History of Humankind, Harper, 2015.
2. Upinder Singh, A History of Ancient and Early Medieval India, Pearson, 2009.
3. Romila Thapar, Early India: From the Origins to AD 1300, University of California Press, 2004.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
ENL 102	Why Read a Book	FC	4	0	0	4

COURSE DESCRIPTION: This course is designed to help students appreciate the importance of books and why reading books is a valuable part of culture and society. This course will increase students reading comprehension, writing and verbal English skills. A group of ancient, modern and postmodern books, poems and articles will be utilized to help students increase their appreciation and analysis of various forms of writing. This course will investigate books as a primal form of cultural and narrative transmission. The readings will include a variety of cross-cultural and multidisciplinary topics.

COURSE OBJECTIVES: Demonstrate an understanding of the value of books and other forms of writing for use professionally, scientifically, socially, and culturally; Paraphrase and cite authors correctly; write and speak well-developed, clear, unified ideas with appropriate college-level language choices; Demonstrate a growing understanding of the art of writing, rhetoric and critical thinking in speaking, writing and in public situations; Complete the assigned readings and maintain good class notes; Course work will include writing assignments, three exams, three quizzes, a review paper, group work, and . . . (?)

ATTENDANCE POLICY: Because work completed in the classroom cannot be duplicated outside the classroom, you must plan to attend class regularly. If you are unable to attend class, contact a student from the class to find out what was covered during class. If you stop attending and do not withdraw, you will receive an "F" as your final grade in this course. Professors assign Incomplete "I" grades only when genuine emergencies prevent a student from completing the class and/or from withdrawing before the deadline and only when the student is earning a satisfactory ("C" or better) grade.

CLASSROOM REGULATIONS: Open and mutually respectful communication of varied opinions, beliefs, and perspectives during classroom discussion encourages the free exchange of ideas that is essential to higher learning. Students should show respect and courtesy to fellow classmates and participate earnestly in class activities. Entering class late, talking during lectures, sleeping during class, making fun of or attacking another's viewpoint, and/or behaving in a disruptive or combative manner are all considered inappropriate and may be grounds for dismissal from class. No use of electronic devices is allowed in class unless specifically related to class work. No classes are to be recorded or photographed with any device without permission of the professor. School policy does not permit students to bring friends or family members to class. Cell phone calls or texting during class are not allowed and will cause you to lose 15 points from your final grade if two written warnings are issued to the student.

LATE WORK: Papers and presentations will be penalized five points for each class late. After 72 hours, I will not accept late papers or projects and you will receive a "0."

ACADEMIC INTEGRITY POLICY:

PURPOSE

As an academic learning community of scholarship, we at SRM University are committed to the principles of truth and honesty in academic endeavours. As faculty and students in this academic community, we are called to present our academic work as an honest reflection of our abilities; we do not need to defraud members of the community by presenting others' work as our own. Therefore, academic dishonesty is handled with serious consequences for two fundamental reasons: it is stealing : taking something that is not ours; it is also lying : pretending

to be something it is not. In an academic community, such preteens are not only unnecessary it is also harmful to the individual and community as a whole. Cheating can have no place on our campus. Only with a truthful presentation of our knowledge can there be an honest evaluation of our abilities. The following acts are those that we consider to be dishonest:

PLAGIARISM: Plagiarism is taking the words, ideas, opinions, theories, or thoughts of another person as your own. Students who present others' words or ideas as their own without fair attribution -documentation, citing sources - are guilty of plagiarizing. This includes, but is not limited to, a direct quotation of all or part of another's words without appropriately identifying the source. It is also wrong to have included a source within a citation page without having carefully cited the source within the text of the document.

CLASSROOM ETIQUETTE: Open and mutually respectful communication of varied opinions, beliefs, and perspectives during classroom discussion encourages the free exchange of ideas that is essential to higher learning. Students should show respect and courtesy to fellow classmates and participate earnestly in class activities. Entering class late, talking during lectures, sleeping during class, making fun of or attacking another's viewpoint, and/or behaving in a disruptive or combative manner are all considered inappropriate and may be grounds for dismissal from class. No use of electronic devices is allowed in class. No classes are to be recorded or photographed with any device without permission of the professor. Cell phones and computers must be off and out of sight during class. **Any use of cell phones or computers during class needs the professor's permission or will result in you losing points from your class grade**.

Course Code	Course Name	Course Category	Credits			
			L	T	P	C
DS 101	Foundations of Data Science	FC	2	2	0	4

UNIT I: DATA VISUALIZATION

John Snow, World Population, Poverty, Education and Health. We will use data from publicly available data sources to plot the relationships between some of the global economic/health indicators. We will use the resulting tables/graphs to write a short report on the possible correlates of global poverty. The labs here will help you with simple exercises of working with tables and also visually observing the data using plots/histograms.

UNIT II: PROBABILITY

This unit will cover the basics of probability, along with Python programming that essentially helps with the probability calculations. The basics will build up to the main question—Why and how did the global financial crisis of 2007/2008 actually occur?

UNIT III: INFERENCE AND AN INTRODUCTION TO PREDICTION

The unit will cover inference- the science of using data and statistics to test hypotheses. We note here that some part of observed differences between countries/individuals/states in any outcome (income, health, a successful business) is possibly due to chance and some of it might be more real/fundamental. We will understand the role of uncertainty in statistical measurements. We will use the concepts learned in a simple model of forecasting/prediction the results of elections.

UNIT IV: REGRESSION ANALYSIS

One of the major tools of data science is regression analysis—a statistical tool that has been widely used and misused- in examining the relationship between two or more variables (e.g., enrolling/graduating in a liberal arts program and empathy, job satisfaction, income, unemployment). We will examine how data visualization can be used to improve the power of regression analysis. We will also examine a potential alternative to regression- the use of experiments where the data collection exercise is carefully supervised. In our project for this unit, we will examine the role of diet in the development of heart disease using some of the data science tools learned in this unit.

UNIT V: MACHINE LEARNING

Perhaps one of the most exciting aspects of data science is the use of machine learning tools in prediction. Many statistical concepts will be introduced in this class (e.g., linear algebra, nearest neighbour classifications) but again the concepts introduced will naturally be right at the tip of the iceberg. The tools discussed in this class will be used in projects such as (a) building a movie recommendation engine, and (b) predicting the probability that an individual develops chronic kidney disease.

TEXTBOOKS AND REFERENCES

1. Computations and Inferential Thinking: The Foundations of Data Science by Ani Adhikari and John DeNero