PERIYAR UNIVERSITY

Reaccredited NAAC 'A' Grade – State University

NIRF Rank 68

Periyar Palkalai Nagar,

Salem-636011

DEPARTMENT OF COMPUTER SCIENCE

MASTER OF COMPUTER APPLICATIONS

[Choice Based Credit System (CBCS)]

OBE REGULATIONS AND SYLLABUS

(Effective from the academic year 2018-2019 and thereafter)

MASTER OF COMPUTER APPLICATIONS
OBE REGULATIONS AND SYLLABUS
(with effect from 2018-2019 onwards)

1. Preamble

The Department of Computer Science was established in 2002, with the objective of imparting quality education in the domain of Computer Science and Applications. With rapidly evolving technology and the continuous need for innovation, the department has always produced quality professionals, holding important positions in Information Technology industries in India and abroad. The Department updates its syllabi frequently to attract young talents from all over the country. The academic activities of the department, during the last four years, were centered on teaching and research programmes in computer science with a view to train post-graduates and researchers who can contribute significantly to the requirements of professional organizations in the field.

2. General Graduate Attributes (MCA)

G.A.1. Core Knowledge Enrichment

Train the students with Deep Core subject knowledge (including the fundamental concepts, computational models, advanced core techniques, appropriate Domain expertise).

Apply the knowledge of deep core concepts to conceptualize the computational models.

Accredited or validated against national or international standards.

G.A.2. Critical Analysis and Decision Making

Skilled with strategic thinking, problem solving, making better use of intuition, learning to evaluate better, and recognizing the essence of things

Analyze the complex problems and to evaluate and assess information in a practical and technical way and ends up with the specialized computational models to provide valid decisions.

G.A.3. Real-Time Project Design and development

Investigating the real world problems to design and develop the computational framework to cope with real world expectations; to fit that model to the complex real-time data and to apply appropriate research methods to synthesis the information to make appropriate decisions

G.A.4. Project Management Capabilities

Trained to apply effective management skills to produce specific project outcomes

G.A.5. Tools usage

Capable to learn and apply recent domain specific knowledge in the computer science and applications industry

G.A.6. Leadership and Team work

Skilled to work effectively as a member and also as a leader in multi-disciplinary teams.

G.A.7. Communication Skills

Trained to communicate the technical aspects with computing professionals and with society at large. Such ability includes listening, reading, speaking and writing, and the ability to comprehend and effective technical report writing and document preparation.

G.A.8. Professionalism

Trained to think and act professionally to adapt themselves in their work places and society to showcase their talents and skills smartly for their self upliftment.

Aware about the cyber regulations and professional ethics, responsibilities and norms of professional computing practice

G.A.9. Advanced Technology Awareness

Trained to update themselves periodically with the current/modern technologies and enrich their knowledge through various online MOOC Courses to cope with the current industrial requirements.

G.A.10. Life Long Learning

To inculcate the passion for continuum learning for a successful professional career

G.A.11. Social Welfare with Ethical Values

Adapt at operating in other cultures, comfortable with different nationalities and social contexts, able to determine and contribute to desirable social outcomes.

Avoiding unethical behavior such as fabrication, falsification of data, committing plagarism

G.A.12. Entrepreneurship

Identify the timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and the society at large.

3. Programme Specific Qualification Attributes

PSQA-GA Mapping

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
K1(Knowledge)	■								■	■		■
K2 (Understanding)	■	■								■		■
K3 (Application level)	■	■	■	■	■					■	■	■
K4 (Analytical level)		■	■	■	■	■	■		■	■		■
K5 (Evaluation capability level)		■	■	■	■	■	■	■	■	■		■
K6 (Scientific or Synthesis level)	■	■	■	■				■	■	■	■	■

4. Vision

Achieving excellence in Information Technology Enabled Services through Teaching, Research, Extension and Consultancy

Mission

To offer accredited postgraduate and research programmes with the state-of-art technology throughout the nation

To maintain high academic standards and teaching quality

To be a centre of excellence for research and innovation in frontier areas of Computer Science and technology relevant to the country.

5. Programme Objectives and Outcomes

Programme Educational Objectives

P.E.O.1. Sound background in fundamental core concepts and computational principles, which are applied for complex problems solving

P.E.O.2. Developing the professional skills and entrepreneur skills with teamwork, leadership and communication qualities

P.E.O.3. Practicing lifelong learning for successful professional career with ethical values

Programme Outcomes (POs) for Master of Computer Applications

P.O.1. Train the students with Deep Core subject knowledge (including the fundamental concepts, computational models, advanced core techniques, appropriate Domain expertise). Apply the knowledge of deep core concepts to conceptualize the computational models. Accredited or validated against national or international standards.

P.O.2. Skilled with strategic thinking, problem solving, making better use of intuition, learning to evaluate better, and recognizing the essence of things. Analyze the complex problems and to evaluate and assess information in a practical and technical way and ends up with the specialized computational models to provide valid decisions.

P.O.3. Investigating the real world problems to design and develop the computational framework to cope with real world expectations; to fit that model to the complex real-time data and to apply appropriate research methods to synthesis the information to make appropriate decisions

P.O.4. Trained to apply effective management skills to produce specific project outcomes

P.O.5. Capable to learn and apply recent domain specific knowledge in the computer science and applications industry

P.O.6. Skilled to work effectively as a member and also as a leader in multi-disciplinary teams.

P.O.7. Trained to communicate the technical aspects with computing professionals and with society at large. Such ability includes listening,

reading, speaking and writing, and the ability to comprehend and effective technical report writing and document preparation.

P.O.8. Trained to think and act professionally to adapt themselves in their work places and society to showcase their talents and skills smartly for their self upliftment. Aware about the cyber regulations and professional ethics, responsibilities and norms of professional computing practice

P.O.9. Trained to update themselves periodically with the current/modern technologies and enrich their knowledge through various online MOOC Courses to cope with the current industrial requirements.

P.O.10. To inculcate the passion for continuum learning for a successful professional career

P.O.11. Adapt at operating in other cultures, comfortable with different nationalities and social contexts, able to determine and contribute to desirable social outcomes. Avoiding unethical behavior such as fabrication, falsification of data, committing plagiarism

P.O.12. Identify the timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and the society at large.

PEO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
PEO 1												
PEO 2												
PEO 3												

PO-GA Mapping

	GA 1	GA 2	GA 3	GA 4	GA 5	GA 6	GA 7	GA 8	GA 9	GA 10	GA 11	GA 12
PO1												
PO2												
PO3												
PO4												
PO5												
PO6												
PO7												
PO8												
PO9												
PO10												
PO11												
PO12												

Programme Specific Outcomes

P.S.O.1. To develop the abilities to acquire deep knowledge of fundamental and core theoretical and programming concepts for holistic development

P.S.O.2. Design, develop and test the software systems for real-time socio-economic problems

P.S.O.3. Analyze and recommend appropriate IT Solutions

6. Candidate Eligibility for M.C.A. Programme Admission

Candidates who have passed in any one of the following or equivalent are eligible to apply:

(i) Bachelor's Degree (under 10+2+3/4) in any subject with Mathematics at +2 level

OR

(ii) Bachelor's Degree (under10+2+3/4) in any subject with Mathematics / Statistics as one of the subjects.

7. Duration of the Programme and Medium

The programme shall be of three years duration spread over six semesters under choice based credit system. The Maximum duration to complete the course shall be three academic years after normal completion of the programme. The medium of instruction/study is English.

8. CBCS - Structure of the Programme

Course Component	No. of Courses	Hours of Learning per week	Marks	Credits
Semester I				
Part A (Credit Courses)				
Core Courses	5	20	500	20
Supportive Courses	-	-	-	-
Core Practical	2	20	200	4
Online Courses	-	-	-	-
Total	7	40	700	24
Part B (Self-Learning Credit Courses)				
Self Supportive Practical	1	2	100	1
Total	1	2	100	1
Semester II				
Part A (Credit Courses)				
Core Courses	4	16	400	16
Supportive Courses	1	3	100	3
Core Practical	2	4	200	4
Online Courses	-	-	-	-
Total	7	23	700	23
Part B (Self-Learning Credit Courses)				
Self Supportive Practical	1	2	100	1
	1	2	100	1

Semester III				
Part A (Credit Courses)				
Core Courses	3	12	300	12
Elective Courses	1	3	100	3
Supportive Courses	1	4	100	4
Core Practical	3	11	300	6
Online Courses	-	-	-	-
Total	7	30	800	25
Part B (Self-Learning Credit Courses)				
Total				
Semester IV				
Part A (Credit Courses)				
Core Courses	3	12	300	12
Elective Courses	2	6	200	6
Supportive Courses	-	-	-	-
Core Practical	3	10	300	6
Online Courses	-	-	-	-
Total	8	28	800	24
Part B (Self-Learning Courses)				
Human Rights	-	2	100	-
	-	2	100	-

Semester V				
Part A (Credit Courses)				
Core Courses	2	8	200	8
Elective Courses	3	9	300	9
Supportive Courses	-	-	-	-
Core Practical	2	6	200	6
Online Courses	-	-	-	-
Total	8	23	700	23
Part B (Self-Learning Credit Courses)				
Mini Project	1	2	100	1
Total				
Semester VI				
Part A (Credit Courses)				
Core Courses	1	-	200	15
Total	1	-	200	15

9. Curriculum structure for each semester as per your courses alignment

Course	*Category	Number of Credits	Hours Per Week	Examination Duration (hrs)	Hours per Week		
					L	T	P
Semester-I							
Course - 18UPCSC1C01 Digital Principles and Computer Organization	CC	4	4	3	4	-	-
Course - 18UPCSC1C02 OOPS with Python	CC	4	4	3	3	1	-
Course - 18UPCSC1C03 Data Structures	CC	4	4	3	3	1	-
Course - 18UPCSC1C04 Front End Tool	CC	4	4	3	3	1	-
Course - 18UPCSC1C05 Problem Solving Techniques	CC	4	4	3	3	1	-
Course - 18UPCSC1C06 Problem Solving - **Lab**	CC	2	4	3	-	-	4
Course – 18UPCSC1C07 Data structures – **Lab**	CP	2	4	3	-	-	4
Course – 18UPCSC1C08 Python – **Lab**	CP	1	2	3	-	-	2
Semester-II							
Course - 18UPCSC1C09 Relational Data Base Management Systems	CC	4	4	3	3	1	-
Course - 18UPCSC1C10 Operating Systems	CC	4	4	3	3	1	-
Course - 18UPCSC1C11 Software Engineering	CC	4	4	3	4	-	-
Course - 18UPCSC1C12 Computer Networks	CC	4	4	3	3	1	-
Supportive – I	SC	3	3	3	3	-	-
Course - 18UPCSC1C13 Operating Systems–**Lab**	CC	2	4	3	-	-	4
Course - 18UPCSC1C14 RDBMS–**Lab**	CP	2	4	3	-	-	4

Course - 18UPCSC1C15 Financial Computing – **Lab**	CP	1	2	3	-	-	2
SWAYAM-MOOC-II	OC						

Semester-III							
Course – 18UPCSC1C16 Java Programming	CC	4	4	3	4	-	-
Course – 18UPCSC1C17 Discrete Mathematics	CC	4	4	3	3	1	-
Course – 18UPCSC1C18 Cryptography and Network Security	CC	4	4	3	3	1	-
Elective Course – I	EC	3	3	3	2	1	-
Supportive - II	SC	4	4	3	3	1	-
Course – 18UPCSC1C19 Java Programming –Lab	CP	2	4	3	-	-	4
Course – 18UPCSC1C20 Web Technology (Open Source Lab) – Lab	CP	2	4	3	-	-	4
Course – 18UPCSC1C21 Soft Skill Development Lab	CP	1	2	3	-	-	2
SWAYAM-MOOC-IV	OC						
Semester-IV							
Course – 18UPCSC1C22 Data Mining	CC	4	4	3	3	1	-
Course – 18UPCSC1C23 Dot Net Programming	CC	4	4	3	3	1	-
Course – 18UPCSC1C24 Computer Vision	CC	4	4	3	4	-	-
Elective Course – II	EC	4	3	3	3	-	-
Elective Course – III	EC	3	3	3	3	-	-
Course – 18UPCSC1C25 Data Mining – Lab	CP	2	4	3	-	-	4
Course – 18UPCSC1C26 Dot Net Programming – Lab	CP	2	4	3	-	-	4
Course – 18UPCSC1C27 Mobile Application Development - Lab	CP	1	2	3	-	-	2

Human Rights							
SWAYAM-MOOC-IV	OC						
Semester-V							
Course-18UPCSC1C28 Big Data Analytics	CC	4	4	3	4	-	-
Course – 18UPCSC1C29 Cloud Computing	CC	4	4	3	3	1	-
Elective Course –IV	EC	3	3	3	2	1	-
Elective Course –V	EC	3	3	3	2	1	-
Elective Course – VI	EC	3	3	3	2	1	-
Course-18UPCSC1C30 Big Data Analytics – **Lab**	CP	2	4	3	-	-	4
Course-18UPCSC1C31 Cloud Computing **– Lab**	CP	2	4	3	-	-	4
Course-18UPCSC1C32 Mini Project/Industrial Training	CP	1	2	3	-	-	2
SWAYAM/MOOC-V	OC						
Semester-VI							
Course-18UPCSC1C33 Dissertation and Viva-Voce	CP	15	-	-	-	-	-

Total no. of Credits **Core** **Elective** Supportive	 112 18 7					
Grand Total	137					
Total Marks						4500

*(Core Course – CC

Supportive Course – SC
Elective Course – EC
Online Course - OC
Core Practical – CP)

List of Electives:

Elective Course - I
Course 18UPCSC1E01 - Microprocessors
Course 18UPCSC1E02 - Parallel Processing
Course 18UPCSC1E03 - Graph Theory
Course 18UPCSC1E04 - Computer Graphics

Elective Course - II
Course 18UPCSC1E05 - Object Oriented Analysis and Design
Course 18UPCSC1E06 - Robotics
Course 18UPCSC1E07 - Web Services
Course 18UPCSC1E08 - Theory of Computation

Elective Course - III
Course 18UPCSC1E09 - Statistical Computing
Course 18UPCSC1E10 - Optimization Technique
Course 18UPCSC1E11 - Wireless Networks
Course 18UPCSC1E12 - Numerical Methods

Elective Course – IV
Course 18UPCSC1E13 - Internet of Things
Course 18UPCSC1E14 - Software Project Management
Course 18UPCSC1E15 - Network Programming
Course 18UPCSC1E16 - Natural Language Processing

Elective Course – V
Course 18UPCSC1E17 - Soft Computing
Course 18UPCSC1E18 - Deep Learning
Course 18UPCSC1E19 - Artificial Neural Network
Course 18UPCSC1E20 - Machine Learning Techniques

Elective Course –VI
Course 18UPCSC1E21 - Mobile Computing
Course 18UPCSC1E22 - Cyber Security
Course 18UPCSC1E23 – Embedded Computing
Course 18UPCSC1E24 - Data Visualisation

IA – Internal Assessments
ESE– End Semester Examinations
Core Course Code : 18UPCSC1C -
Elective Course Code : 18UPCSC1E -

10. Credit Calculation

Method of teaching	Hours	Credits
Lecture	1	1
Tutorial/Demonstration	1	1
Practical/Internship/self-Learning	2	1

11. CBCS – Scheme of Examinations semester wise structure

Course	*Category	Number of Credits	Hours Per Week	Examination Duration (hrs)	Marks		
					I.A	ESE	Total
Semester-I							
Course - 18UPCSC1C01 Digital Principles and Computer Organization	CC	4	4	3	25	75	100
Course - 18UPCSC1C02 OOPS with Python	CC	4	4	3	25	75	100
Course - 18UPCSC1C03 Data Structures	CC	4	4	3	25	75	100
Course - 18UPCSC1C04 Front End Tool	CC	4	4	3	25	75	100
Course - 18UPCSC1C05 Problem Solving Techniques	CC	4	4	3	25	75	100
Course - 18UPCSC1C06 Problem Solving - **Lab**	CC	2	4	3	40	60	100

Course – 18UPCSC1C07 Data structures – **Lab**	CP	2	4	3	40	60	100
Course – 18UPCSC1C08 Python – **Lab**	CP	1	2	3	60	60	100
Semester-II							
Course - 18UPCSC1C09 Relational Data Base Management Systems	CC	4	4	3	25	75	100
Course - 18UPCSC1C10 Operating Systems	CC	4	4	3	25	75	100
Course - 18UPCSC1C11 Software Engineering	CC	4	4	3	25	75	100
Course - 18UPCSC1C12 Computer Networks	CC	4	4	3	25	75	100
Supportive – I	SC	3	3	3	25	75	100
Course - 18UPCSC1C13 Operating Systems– **Lab**	CC	2	4	3	40	60	100
Course - 18UPCSC1C14 RDBMS–**Lab**	CP	2	4	3	40	60	100
Course - 18UPCSC1C15 Financial Computing – **Lab**	CP	1	2	3	40	60	100
SWAYAM-MOOC-II	OC						
Semester-III							
Course – 18UPCSC1C16 Java Programming	CC	4	4	3	25	75	100
Course – 18UPCSC1C17 Discrete	CC	4	4	3	25	75	100

Mathematics							
Course – 18UPCSC1C18 Cryptography and Network Security	CC	4	4	3	25	75	100
Elective Course – I	EC	3	3	3	25	75	100
Supportive - II	SC	4	4	3	3	1	-
Course – 18UPCSC1C19 Java Programming – Lab	CP	2	4	3	40	60	100
Course – 18UPCSC1C20 Web Technology (Open Source Lab) – Lab	CP	2	4	3	40	60	100
Course – 18UPCSC1C21 Soft Skill Development Lab	CP	1	2	3	40	60	100
SWAYAM-MOOC-IV	OC						
Semester-IV							
Course – 18UPCSC1C22 Data Mining	CC	4	4	3	25	75	100
Course – 18UPCSC1C23 . Net Programming	CC	4	4	3	25	75	100
Course – 18UPCSC1C24 Computer Vision	CC	4	4	3	25	75	100
Elective Course – II	EC	4	3	3	25	75	100
Elective Course – III	EC	3	3	3	25	75	100
Course – 18UPCSC1C25 Data Mining (Using Python) – Lab	CP	2	4	3	40	60	100
Course – 18UPCSC1C26	CP	2	4	3	40	60	100

. Net Programming – Lab							
Course – 18UPCSC1C27 Mobile Application Development - Lab	CP	1	2	3	40	60	100
Human Rights					25	75	100
SWAYAM-MOOC-IV	OC						
Semester-V							
Course- 18UPCSC1C28 Big Data Analytics	CC	4	4	3	25	75	100
Course – 18UPCSC1C29 Cloud Computing	CC	4	4	3	25	75	100
Elective Course –IV	EC	3	3	3	25	75	100
Elective Course –V	EC	3	3	3	25	75	100
Elective Course – VI	EC	3	3	3	25	75	100
Course- 18UPCSC1C30 Big Data Analytics – **Lab**	CP	2	4	3	40	60	100
Course- 18UPCSC1C31 Cloud Computing – **Lab**	CP	2	4	3	40	60	100
Course- 18UPCSC1C32 Mini Project	CP	1	2	3	40	60	100
SWAYAM/MOOC-V	OC						
Semester-VI							
Course- 18UPCSC1C33 Dissertation and Viva-Voce	CP	15	-	-	50	150	200

12. Examinations

Examinations are conducted in semester pattern. The examination for the Semester I & III will be held in November/December and that for the Semester II and IV will be in the month of April/May.

Candidates failing in any subject (both theory, practical and skill) will be permitted to appear for such failed subjects in the same syllabus structure at subsequent examinations within next 5 years. Failing which, the candidate has to complete the course in the present existing syllabus structure.

13. Scheme for Evaluation and Attainment Rubrics

Evaluation will be done on a continuous basis and will be evaluated four times during the course work. The first evaluation will be in the 7th week, the second in the 11th week, third in the 16th week and the end – semester examination in the 19th week. Evaluation may be by objective type questions, short answers, essays or a combination of these, but the end semester examination is a University theory examination with prescribed question paper pattern.

Attainment Rubrics for Theory Courses

THEORY EXAMINATION

Evaluation of Internal Assessment

Test : 5 Marks (Best one out of Two Tests) :
Model Examination : 5 Marks
Seminar : 5 Marks
Assignment : 5 Marks
Attendance : 5 Marks

Total : 25 Marks

***** No Internal Minimum**

Evaluation of End Semester Examinations

Question Paper Pattern (Theory)

Section	Approaches	Mark Pattern	K Level	CO Coverage
A	One word (Answer all questions)	20X1 = 20 (Multiple Choice Questions)	K1-K3	-
B	100 to 200 words (Answer any three out of five questions)	3X5 = 15 (Analytical type questions)	K4	-
C	500 to 1000 words	5X8 = 40 (Essay type questions)	K1-K4	-

Attainment Rubrics for Lab Courses

PRACTICAL \ MINI PROJECT EXAMINATION

Evaluation of Internal Assessment

Test 1 : 20 Marks

Test 2 : 20 Marks (Best one out of Two Tests)

Test 3 : 20 Marks

Total : 40 Marks

***** No Internal Minimum**

QUESTION PAPER PATTERN

Time duration: 3 Hours

Max. Marks: 60

Questions may be taken from the list of practical problems: 60 Marks

Distribution of the Marks

(i) Practical/Mini project

- Record Note Book 10
- Problem Understanding 10
- Implementation 20
- Debugging and Modification 10
- For correct output and viva 10

(ii) Industrial Training

- Internal Assessment 40
- Joint Viva-voce 60

(Internal Examiner 30 and External Examiner 30)

(iii) Dissertation

- Internal Assessment 50
- Report Evaluation by External Examiner 50
- Joint Viva-voce 100

(Internal Examiner 50 and External Examiner 50)

REGULATIONS FOR DISSERTATION WORK

- Students should attach themselves with well reputed Industry/Company/Institutions to do their five months dissertation work.
- The Candidate should submit the filled in format to the department for approval during the First week of December during the even semester.
- The review of the dissertation will be carried out periodically.
- The student should submit three copies of their dissertation work.
- The students may use OHP/Power Point presentation during their dissertation Viva-Voce examinations.

PASSING MINIMUM

The candidate shall be declared to have passed in the theory/practical/Dissertation examination if the candidate secures:

(i) 50% marks in the ESE and

(ii) 50% in ESE and IA put together

14. Grading System

Evaluation of performance of students is based on ten-point scale grading system as given below.

Ten Point Scale			
Grade of Marks	**Grade points**	**Letter Grade**	**Description**
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

Semester-I

Course Code-18UPCSC1C01 **Credits 4**

DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION

Course Objective

- To describe the basic concepts of data representation and data processing circuits.
- To expose students to the basic architecture of processing, memory and i/o organization in a computer system
- To learn with the advanced concept of Central Processing Unit, Input/output Unit and Memory Unit.
- To appraise and compare different methods for computer I/O.

Syllabus

Unit-I

Number Systems: Binary Number System, Binary-to-decimal Conversion, Decimal-to-binary Conversion, Octal Numbers, Hexadecimal Numbers, The ASCII Code, The Excess-3 Code, The Gray Code, -Binary Addition, Subtraction, Multiplication and Division Codes – BCD Weighted - Excess- Gray -Error Detection Codes. Basic Logic Gates – Boolean laws and theorems - Sum of products – product of sums - Karnaugh map simplification methods - don't care conditions. *Case study:* Add two gray coded numbers 0100 and 0111 and express the result in gray code.

Unit-II

Data processing circuits – Multiplexers – Demultiplexers – Decoders – Encoders –Arithmetic Building Blocks: Half and Full Adder: Subtractor, adder - TTL circuits – CMOS circuit. Flip-Flops: RS, Clocked RS, D-Edge – Triggered D, JK, Master/slave flip-flop-clocks and timers-counters, Asynchronous counters, Synchronous counters-MOD3, MOD5, Shift counters. *Case study* : Show how data processing circuits can be used to compare two 2-bit numbers, A1 A0 and B1 B0 to generate two outputs, A>Band A= B.

Unit-III

Central Processing Unit: Introduction – General Register Organization – Stack Organization – Instruction Formats – Addressing Modes – Data Transfer and Manipulation – Program Control Reduced Instruction Set Computer (RISC). *Case study*: Convert the following numerical arithmetic expression into reverse Polish notation and show the stack operations for evaluating the numerical result. (3+4)[10(2+6) + 8]

Unit-IV

Input - Output Organization: Peripheral Devices – Input-Output Interface Asynchronous Data Transfer – Modes of Transfer – Priority Interrupt – Direct Memory Access (DMA) – Input- Output Processor (IOP) – Serial Communication. *Case study:* Write your full name in ASCII using eight bits per character with the leftmost bit always 0. Include a space between names and a period after middle initial.

Unit-V

Memory Organization: Memory Hierarchy – Main Memory – Auxiliary Memory – Associative Memory – Cache Memory – Virtual Memory – Memory Management Hardware. Control Unit: Control Memory – Address Sequencing, Conditional Branching Mapping of Instruction Subroutines – Design of Control Unit, Micro program Sequencer, Problems.

Text Book

1. Albert Paul Malvino, Donals P. Leach, Goutam Saha, Digital Principles and Applications, McGrawHill, SeventhEdition, 2011.Chapters: 4 (1 , 2 , 3 , 6) ,5 (1 , 2 , 3 , 4 , 5 , 6 , 7 , 8) , 6 (1 , 2 , 1 1)
2. M. Morris Mano, Computer System Architecture, Prentice-Hall India Third Edition, 2005. Chapters 7(1, 2, 4), 8, 11, 12.

Reference Book

1. Thomas C. Bartee, -Digital Computer Fundamentals, Tata McGraw Hill, 1996.
2. M. Morris Mano, -Digital Logic and Computer Design Prentice – Hall of India, 1979.
3. Albert Paul Malvino, Donals P. Leach, Goutam Saha, Digital Principles and Applications, McGraw Hill, Seventh Edition, 2010.Chapters:6(1,2,9),4(1to6),6(7,8),7(1,2,4),8(1,2,4,5),10(1,3,7), 13(10).

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Articulate the basic concepts of number system	K4,K5, K6
CO2:	Appraise the design and functioning of a machines central processing unit (CPU).	K1, K2
CO3:	Design concept of input, output and memory organization	K3
CO1:	Articulate the basic concepts of number system	K4,K5, K6
CO2:	Appraise the design and functioning of a machines central processing unit (CPU).	K1, K2

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	M	-	-	M	-	-	-	S	-
CO2	S	S	S	M	-	-	S	-	-	-	L	-
CO3	S	S	S	S	-	-	S	-	-	-	L	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C02 **Credits 4**

OBJECT ORIENTED PROGRAMMING WITH PYTHON

Course Objective

- To acquire programming skills in core Python.
- To develop object oriented skills in Python.
- To realize why python is a useful scripting language for developers.
- To define the structure and components of a python program.
- To learn how to use exception handling in python.

Syllabus

Unit – I

Rapid Introduction to Procedural Programming: Creating and Running Python Programs - Data Types - Object References - Collection Data Types - Logical Operations - Control Flow Statements - Arithmetic Operators - Input/Output - Creating and Calling Functions – Data Types: Identifiers and Keywords - Integral Types - Integers - Booleans - Floating-Point Types - Floating-Point Numbers - Complex Numbers - Decimal - Strings - Comparing - Slicing and Striding Strings - String Operators and Methods - Formatting with the str.format() Method - Character Encodings.

Unit – II

Collection Data: Sequence Types - Tuples - Named Tuples - Lists - Set Types - Sets - Frozen Sets - Mapping Types - Dictionaries - Default Dictionaries- Ordered Dictionaries - Iterating and Copying Collections - Iterators and Iterable Operations and Functions - Copying Collections - Control Structures and Functions : Control Structures - Conditional Branching - Looping - Exception Handling - Catching and Raising Exceptions - Custom Exceptions - Custom Functions - Names and Docstrings - Argument and Parameter Unpacking - Accessing Variables in the Global Scope - Lambda Functions – Assertions

Unit – III

Modules : Modules and Packages - Packages - Custom Modules – Overview of Python‘s Standard Library - String Handling - Command-Line Programming - Mathematics and Numbers - Times and Dates - Algorithms and Collection Data Types - File Formats, Encodings, and Data Persistence File, Directory, and Process Handling - Networking and Internet Programming - XML - Other Modules - Object-oriented Design : Introducing object-oriented - Objects and classes - Specifying attributes and behaviors - Data describes objects - Behaviors are actions - Hiding details and creating the public interface - Composition - Inheritance - Inheritance provides abstraction - Multiple inheritance

Unit – IV

Objects in Python - Creating Python classes - Adding attributes - Making it do something - Initializing the object - Explaining yourself – Data Accessing - Third-party libraries - Basic inheritance - Extending built-ins - Overriding and super - Multiple inheritance - The diamond problem - Different sets of arguments - Polymorphism - Abstract base classes - Using an abstract base class - Creating an abstract base class -Demystifying the magic

Unit – V

Expecting the unexpected : Raising an exception - The effects of an exception - Handling exceptions - The exception hierarchy - Defining our own exceptions - When to Use Object-oriented Programming - Treat objects as objects - Adding behavior to class data with properties - Properties in detail - Decorators – another way to create properties - Deciding when to use properties - Manager objects - Removing duplicate code - An alternative to method overloading - Default arguments - Variable argument lists - Unpacking arguments - Functions are objects too - Using functions as attributes - Callable objects.

Text book

1. Dusty Phillips, ―Python 3 Object-oriented Programming ‖, Second Edition, PACKT Publishing, 2015. Chapters – 1-5,7 (http://file.allitebooks.com/20160830/Python%203%20Object-Oriented%20Programming, % 20 Second%20Edition.pdf)
2. Mark Summerfield, ―Programming in Python 3 A Complete Introduction to the Python Language, Second Edition, Pearson Education, 2010.

Chapters:1-5
(http://file.allitebooks.com/20150514/Programming%20in%20Python% 203,%202nd%20Edition.pdf)

Reference

1. Kenneth A. Lambert, — Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
2. Paul Gries, Jennifer Campbell and JasonMontojo,—Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC,2013 11.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, —Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd., 2015.

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Learn to solve problems using features of python programming	K1,K2	LO
CO2:	Appraising and applying the data types and collection data types in python programs	K3	IO
CO3:	Analysis the complete syntax for all of Python's control structures and all the fundamentals of creating functions	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	S	M	-	M	-	M	-	-	-	L	S
CO2	M	S	L	-	S	-	M	-	-	-	M	S
CO3	s	S	M	-	S	-	S	-	-	-	S	S

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C03 **Credits 4**

DATA STRUCTURES

Course Objective

- To impart the basic concepts of data structures and algorithms.
- To apprehend concepts about searching and sorting techniques.
- To deliberate the implementation of different non-linear data structures such as trees and graphs.
- To introduce various internal sorting techniques and analyze their time complexities.
- To understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.

Syllabus

Unit –I

Introduction to Data Structures and Algorithms –Linked Lists: Introduction Singly linked lists - Circular linked lists - Doubly linked lists – Circular Doubly linked lists – Applications of linked lists- Polynomial Representation - Stacks: Introduction to stacks – Array Representations of Stacks – operations on stack – Linked representations of stack – Operation on a linked stack – Applications of Stacks. Queues: Introduction to Queues – Array and linked representations of Queues – Types of Queues – Applications of Queues.

Unit – II

Trees: Introduction – Types of Trees: General Trees – Forests – Binary Trees Binary Search Trees. Traversing a Binary Tree: Pre-order Traversal – In-order Traversal –Post-order Traversal – Level-order Traversal - Applications of Trees Efficient Binary Trees: Binary Search Trees – Operations on Binary Search Trees: Searching for a node in a Binary Search Tree – Inserting a new node in a Binary Search Tree – Deleting a node from a Binary Search Tree – Determining Height and number of nodes in a Binary Search Tree. AVL Trees: Operations on AVL Trees – Searching for a node in an AVL Tree.

Unit – III

Heaps: Binary Heaps – Inserting a new element in a Binary Heap – Deleting a element from a Binary Heap – Applications of Binary Heaps. Graphs: Introduction – Graph Terminology – Directed Graph –Bi-connected Components – Representation of Graphs - Graph Traversal Algorithms: Breadth first search algorithm – Depth first search algorithm. Shortest Path Algorithms: Minimum Spanning Tree – Prim‘s algorithm – Kruskal‘s algorithm – Dijkstra‘s algorithm – Applications of Graphs.

Unit-IV

Sorting: Introduction to Sorting – sorting on multiple keys - Bubble Sort: Technique – Complexity of Bubble sort - Insertion Sort: Technique – Complexity and advantage of insertion sort. Selection Sort: Technique – Complexity and advantage of Selection sort - Merge Sort – Quick Sort: Technique – Complexity and advantage of Quick sort – Radix Sort – Heap Sort – Shell Sort – Tree Sort – Comparison of Sorting Algorithms – External Sorting.

Unit-V

Hashing and Collision: Introduction – Hash Tables – Hash Functions – Different Hash Function: Division method - Multiplication method – Mid Square method – Folding Method – Collision: Collision Resolution by open addressing – Collision Resolution by Chaining – Pros and cons of Hashing – Applications of Hashing.

Text Book

1. ReemaThareja, “Data Structures using C”, Oxford University Press, Second Edition, 2014.

   Unit I: Chapters (2, 6 (6.1-6.5,6.8), 7 (7.1-7.5, 7.7),8)

   Unit II: Chapters (9 (9.1, 9.2 (9.2.1-9.2.4), 9.4, 9.6), 10 (10.1, 10.2 (10.2.1 – 10.2.5), 10.4))

   Unit III: Chapters (12 (12.1, 12.5),13 (13.1 – 13.6, 13.8 (13.8.1- 13.8.4)))

   Unit IV: Chapter (14 (14.6 - 14.17))

   Unit V: Chapter (15 (15.1 – 15.7))

Reference Book

1. Horowitz, Sahni and Anderson-Freed, —Fundamentals of Data Structures in C‖, University Press, Second Edition, 2008.
2. YashavantKanetkar, —Data Structures through C‖, BPB Publications, Second Edition, 2009.
3. Srivastava, —Data Structures through C in Depth‖, BPB Publications, Second Edition, 2011.

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Recognize the usage of various data structures. These include lists, stacks, queues, Trees, and graphs.	K1,K2	LO
CO2:	Categorize the usage of various data structures algorithms such as Searching, Sorting and Merging.	K3	IO
CO3:	Illustrate algorithms and step by step approach in solving problems with the help of fundamental data structures	K4,K5, K6	HO

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	L	L	-	L	-	-	-	-	-
CO2	S	S	S	M	M	-	S	-	-	-	-	-
CO3	S	S	S	M	M	-	S	-	-	-	-	-

Course Code-18UPCSC1C04 **Credits 4**

FRONT END TOOL

Course Objective

- To enable students to develop elegant and responsive Front-end by leveraging latest technologies
- To emphasis on event-driven programming methods, including creating and manipulating objects and classes
- Building Strong expertise to develop front end application using Microsoft Visual Studio 2008 and the Microsoft .NET Framework 3.5

Syllabus

Unit–I

Introduction: Visual Studio Environment- Visual Basic Project –Visual Basic Code Statements – Run the Project- Finding and Fixing Errors – Controls- Working with Multiple Controls- Designing your Applications for User Convenience.

Unit-II

Data - Variables and Constants –Formatting Data for Displaying – Handling Exceptions – Displaying Messages in Message Boxes- List Boxes and Combo Boxes -Decision and Conditions: If Statements – Boolean Expressions- Nested If Statements – Input Validation – Case Structure- Do- Loops- Sharing an Event Procedure- Calling an Event Procedure – Debugging Visual Basic Projects.

Unit–III

Menus – Common Dialog Boxes – Creating Context Menus – Writing General Procedure – Using Multiple Forms – Variable and constants in Multiple Forms- Arrays: Single Dimensional Arrays- For Each/Next Statements – Structures – Multi Dimensional Array.

Unit–IV

Database Applications: Databases – Using ADO. Net and Visual Basics- Creating a Database Application – Binding Individual Data Fields – Selecting Records from the List – Selecting Records using Web Forms

Unit-V

Web Applications: Visual Basic and Web Programming – Creating a Website - Laying out Web Forms- Navigating a Web Forms – Using the Validating Controls- AJAX – Graphics in Windows and Web- Simple Animation- Timer Component-Playing Sounds–Drag and Drop Programming.

Text Book

1. Julia Case Bradley, Anita C. Millspaugh, — PROGRAMMING IN VISUAL BASIC 2008‖.—7th ed., McGraw-Hill, 2009.

   Unit-I (Chapters: 1, 2)
   Unit-II (Chapters: 3, 4)
   Unit-III (Chapters: 5, 6, 7,8)
   Unit-IV (Chapters: 10)
   Unit-V (Chapters: 9, 13)

Reference Book:

1. Tim Patrick, —Programming Visual Basic 2008‖, 1st ed. O'ReillyMedia, 2008.

Course Outcomes

- Able to build various VISUAL BASIC Applications

On the successful completion of the course, students will be able to:

CO1:	To comprehend Visual Studio Environment, Finding and Fixing Errors	K1,K2	LO
CO2:	To apply Data Types and Control Structures for the problems	K3	IO
CO3:	Creation of Menus, MDI forms and Web applications	K4, K5, K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	-	L	-	-	-	-	-
CO2	S	M	M	L	L	-	L	-	-	-	-	-
CO3	S	S	S	M	L	-	L	-	-	-	-	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C05 **Credits 2**

PROBLEM SOLVING TECHNIQUES

Course Objective

- It aims to provide exposure to problem-solving through programming.
- To apprehend the basic concepts of C- Programming language.
- To develop a greater understanding of the issues involved in programming language design and implementation
- Develop an in-depth understanding of functional, logic, and object-oriented programming paradigms

Syllabus

Unit-I

Introduction - The Problem-solving Aspect - Top-down Design- implementation of Algorithms- Program Verification - The Efficiency of Algorithms. Fundamental Algorithms - Exchanging the values of Two Variables - Counting - Summation of a set of Numbers - Factorial Computation-Sine function computation - Generation of the Fibonacci sequence - Reversing the Digits of an Integer - Base Conversion Character to Number Conversion.

Unit-II

Finding the square Root of a number - The Smallest Divisor of an Integer - The Greatest Common Divisor of Two Integers - Generating Prime Numbers - Computing the Prime Factors of an Integer - Generation of Pseudo - random Numbers - Raising a Number to a Large Power - Computing the nth Fibonacci Number.

Unit-III

Array Order Reversal-Array Counting or Histogramming - Finding the Maximum Number in a Set - Removal of Duplicates from an Ordered Array- Partitioning an Array – Finding the kth Smallest Element - Longest Monotone Subsequence.

Unit-IV

Overview of C – Constants, Variables, Data types – Operators – Expressions The Decision Control Structure – The Loop control Structure – The Case Control Structure – Functions and Pointers – Arrays – Pointers and Arrays - Two Dimensional Arrays – Array of Pointers – Three Dimensional Array – Puppetting on Strings – Structures.

Unit-V

File Input / Output – Data Organization – File Operations – File Modes – String (Line) or Record I/O in Files – Text Files and Binary Files – Database Management - Miscellaneous Features – Enumerated Data Type - Typedef – Typecasting – Bit Fields – Pointers to Functions – Functions Returning Pointers – Union of Structures – C Under Windows – DOS and Windows Programming Model.

Text Book

1. R.G.Dromey, — How to Solve it by Computer, Pearson Education, India, 2007. (Chapters: 1, 2, 3, and 4)
2. Yashavant P. Kanetkar, —Let Us C, Fifth Edition, Sridhara Publication, India, 2008. (Chapters: 1, 2, 3, 4, 5, 8, 9, 10, 12, 15, 16, 19)

Reference Book

1. SeymourLipschutz, — Essentials Computer Mathematics‖, Schaums outlines series, Tata McGrawHill Edition, 2004.
2. Kernigan Brian W., and Dennis M. Ritchie, —The C Programming Language, Second Edition, Prentice Hall, 1988.
3. Balagurusamy E,—Programming in ANSI C‖, Third Edition,

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Correlate problem solving method and needed information towards solving problems	K4, K5, K6	HO
CO2:	Develop the solutions using conditional and iterative statements, user defined functions to solve real time problems	K3	IO
CO3:	Understand the logics of the problem solving techniques	K1,K2	LO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	-	-	-	M	M	-	S	-
CO2	S	S	S	M	-	-	-	S	L	-	L	-
CO3	S	S	S	S	-	-	-	S	L	-	L	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C06 **Credits 2**

PROBLEM SOLVING LAB

Course Objective

- To acquire problem solving skills
- To be able to write programs in C Language
- To recognize structured programming concepts
- To enhance their exploring and problem solving skills and use the same for writing programs in C

List of Programs

1. Write a C program to compute the factorial of an integer
2. Write a C program to generate the Fibonacci sequence using recursive function
3. Write a C program to check whether the word is palindrome or not
4. Write a C program to find the square root of a given number
5. Write a C program to generate prime numbers upto an integer
6. Write a C program to find the GCD of two integers
7. Write a C program to remove the duplicates from an ordered array
8. Write a C program to find smallest and largest number present in an array
9. Write a C program to sort the elements of an increasing order
10. Create a C Program with structure to specify data on students given below

    Roll no, Name, Department, Course, Year of joining. Assume that there are 100 students in the department

    a) Write a function to print names of all students who joined in a particular year.

    b) Write a function to print the data of students whose roll number is given.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Interpret the concepts in problem solving	K1, K2	LO
CO2:	Analyse real time problems and implement the solutions for it	K4,K5,K6	HO
CO3:	Develop c programs using conditional and iterative statements	K3	IO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	M	-	-	-	M	M	-	S	-
CO2	S	S	M	S	-	-	-	M	M	-	M	-
CO3	S	S	L	M	-	-	-	M	M	-	M	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C07 **Credits 2**

DATA STRUCTURE – LAB

Course Objective

- To develop skills to design and examine simple linear and nonlinear data structures.
- Able to identify and apply the suitable data structure for the given real world problem.
- To gain knowledge in practical applications of data structures

List of Programs

To implement the following using C

1. Stack
2. Queue
3. Singly Linked List
4. Circular Linked List
5. Doubly Linked List
6. Polynomial Addition using Singly Linked List
7. Tree traversal
8. Quick Sort
9. Merge Sort
10. Heap Sort

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Develop appropriate data structures as applied to specified problem definition	K1,K2	LO
CO2:	Collobrate operations like searching, insertion, and deletion, traversing mechanism etc. on various data structures	K3	IO
CO3:	Implement Linear and Non-Linear data structures for complex programs	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	L	S	M	M	L	L	L		
CO2	S	S	S	S	S	M	S	L	L	L		
CO3	S	S	M	M	S	M	M	L	L	M		

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C08 **Credits 1**

PYTHON LAB

Course Objective

- To develop a basic understanding of programming and the Python programming language
- Able to identify, formulate and solve real world problems using python programming

List of Programs

Implement the following in Python 3 version:

1. Arithmetic and Boolean Operations
2. String Operations
3. Control Structures : Conditional and Looping
4. Creation of User-defined Functions
5. Exceptional Handling
6. Create and Import Built-in and Custom Modules
7. Working of classes and objects
8. Class method and static method
9. Constructors
10. Inheritance

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Understand the data structure control structure and oops concepts of Python	K1,K2	LO
CO2:	Develop python program for simple problems	K3	IO
CO3:	Create user defined functions and modules for real time problems	K4, K5,K6	HO

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	L	M	M	M	L	L	L		
CO2	S	M	L	S	S	M	S	L	L	L		
CO3	S	S	M	M	S	M	M	L	L	M		

S- Strong; M-Medium; L-Low

Semester-II

Course Code-18UPCSC1C09 **Credits 4**

RELATIONAL DATABASE MANAGEMENT SYSTEMS

Course Objective

- To gain acquaintance of DBMS, both in terms of use and implementation/design
- To expose the students the fundamentals & basic concepts in relational Data Base Management Systems.
- To understand and successfully apply logical database design principles, including E-R diagrams and relational model.
- Apprehend the needs of database processing and learn techniques for controlling the consequences of concurrent data access.
- To describe and discuss selected advanced database topics, such a Security and the data warehouse.

Syllabus

Unit-I

Introduction to Database Systems: Overview – Data Models – Database System Architecture– History of Database Systems. Diagram – Weak Entity Sets – Extended E-R Features –Design of an E-R Database Schema – Reduction of E-R Schema to Tables. Entity Relationship Model: Basic Concepts – Constraints – Keys – Design Issues – Entity Relationship.

Unit-II

Relational Model: Structure of Relational Databases – Relational Algebra – Extended Relational Algebra Operations – Modification of Database –Views– Tuple Relational Calculus – Domain Relational Calculus. SQL: Basic Structure – Set Operations – Aggregate Functions - Null Values – Nested Sub queries –Modification of the database –Joined Relations– Embedded SQL – Dynamic SQL –Query-by-Example, Quel.

Unit-III

Integrity and Security: Domain Constraints – Referential Integrity – Assertions – Triggers –Security and Authorization – Authorization in SQL – Encryption and authentication. Relational Database Design: First Normal Form – Second Normal Form– Boyce-Codd Normal Form –Third Normal Form– Fourth Normal Form.

Unit-IV

Storage and File Structures: Overview of Physical Storage Media –Magnetic Disks – RAID – Tertiary Storage – Storage Access – File Organization – Organization of Records in Files – Data - Dictionary Storage. Indexing and Hashing: Basic Concepts – Ordered Indices – B+-Tree Index Files – B-Tree Index Files – Static Hashing – Dynamic Hashing Index Definition in SQL – Multiple-Key Access. Query Processing: Measures of Query Cost – Selection Operation – Join Operation. Query Optimization: Overview - Estimating Statistics of Expression Results.

Unit-V

Transactions: Transaction concept – Transaction State – Implementation of Atomicity and Durability – Concurrent Executions – Serializability – Recoverability –Implementation of Isolation – Transaction Definition in SQL – Testing for Serializability Concurrency Control: Lock-Based Protocols – Timestamp-Based protocols – Validation- Based Protocols – Multiple Granularity – Deadlock Handling- Weak Levels of Consistency: Degree Two Consistency – Cursor Stability. Recovery System: Failure Classification – Storage Structure – Recovery and Atomicity – Log-Based Recovery – Shadow Paging – Recovery with concurrent Transactions – Buffer Management – Failure with Loss of Non – volatile Storage.

Text Book

1. A.Silberschatz, N.F.Korth, S.Sudarshan, Database System Concepts, 6thEdition – McGraw Hill Higher Education, International Edition2011. (Chapters: 1 to 7, 11, 12, 13, 14, 15 to17)

Reference Book

1. Fred R McFadden, Jeffery A Hoffer, Mary B. Prescott, —Modern Database Management‖, Fifth Edition, Addison Wesley,2000.
2. R. Elmasri and S.B. Navathe Benjamin Cummings, —Fundaments of Database Systems‖, Redwood City, 1994.
3. B.C. Desai, —An Introduction to Database Systems, Galgotia Publication, New Delhi, 1995.

Course outcome

On the successful completion of the course, students will be able to:

CO1:	To describe and discuss data principles, data models selected advanced database topics, such a Security and the data warehouse	K1,K2	LO
CO2:	Apprehend the needs of database processing using techniques for controlling the consequences of concurrent data access.	K3	IO
CO3:	Analyse and design the appropriate database models for the real time problems	K4, K5, K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	-	L	-	-	-	-	-
CO2	S	M	M	L	L	-	L	-	-	-	-	-
CO3	S	L	S	M	L	-	L	-	-	-	-	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C10 **Credits 4**

OPERATING SYSTEM

Course Objective

- To paraphrase the fundamentals of Operating Systems.
- To learn the mechanisms of OS to handle processes and threads and their communication
- To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms and deadlock detection algorithms.
- To comprehend the structure and organization of the file system
- Able to use system calls for managing processes, memory and the file system.

Syllabus

Unit I:

Introduction to Operating Systems: What is Operating Systems – Early History: The 1940s to 1990s, and 2000 and beyond. Operating System Components and Goals: Core Operating System Components – Operating System Goals -Operating System Architectures. Process: Introduction – Process States – Process Management – Interrupts – Inter process Communication. Case Study: UNIX Processes.

Unit II:

Asynchronous Concurrent Execution: Introduction - Mutual Exclusion – Implementing Mutual Exclusion Primitives – Software solutions to the Mutual Exclusion Problem: Dekker‘s Algorithm – Peterson‘s Algorithm. Hardware solutions to the Mutual Exclusion Problem: Disabling Interrupts - Test and Set Instruction – Swap Instruction. Semaphores: Mutual Exclusion with Semaphore – Thread Synchronization with Semaphore – Counting Semaphore – Implementing Semaphores. Concurrent Programming: Introduction – Monitors: Condition Variables – Simple Resource Allocation with Monitors – Monitor Examples: Circular Buffer - Readers and Writers - Java Monitors.

Unit III:

Deadlock and indefinite Postponement: Introduction – Examples of Deadlock: Traffic Deadlock – Simple Resource Deadlock – Deadlock in Spooling Systems – Dinning Philosophers - Resource Concepts – Four Necessary Conditions for Deadlock – Deadlock Solutions – Deadlock Prevention. Deadlock Avoidance with Dijkstra's Banker's Algorithm: Example of a Safe and unsafe State - Example of a State Safe to unsafe State Transition – Banker's Algorithm Resource Allocation – Weakness in the Banker's Algorithm - Deadlock Detection – Deadlock Recovery. Process Scheduling: Introduction – Scheduling levels – Preemptive Vs Nonpreemptive Scheduling – Priorities – Scheduling Objectives – Scheduling Criteria – Scheduling Algorithms.

Unit IV:

Physical and Virtual Memory: Introduction – Memory Organization – Memory Management – Memory Hierarchy – Memory Management Strategies – Contiguous Vs Noncontiguous Memory Allocation. Single-User Contiguous Memory Allocation: Protection in a Single User System – Single Stream Batch Processing - Fixed Partition Multiprogramming – Variable Partition Multiprogramming – Multiprogramming with Memory Swapping. Virtual Memory Organization: Introduction – Virtual Memory Basics – Block Mapping - Paging – Segmentation – Segmentation / Paging Systems.

Unit V:

Virtual Memory Management: Introduction – Demand Paging - Anticipatory Paging – Page Replacement – Page Replacement Strategies – Page Fault Frequency (PFF) Page Replacement – Page Release – Page Size – Program Behavior under Paging – Global Vs Local Page Replacement. Disk Performance Optimization: Introduction – Evolution of Secondary Storage Characteristics of Moving Head Disk Storage – Why Disk Scheduling Is Necessary – Disk Scheduling Strategies – Rotational Optimization.

Text Book

1. Harvey M. Deitel, Paul J.Deitel and David R. Choffness, "Operating System", Pearson, 2013. (Third Edition)

Unit 1: Part 1(1) (1.1,1.2,1.3,1.4,1.5,1.6,1.8,1.9,1.12,1.13) Part 2(3) (3.1 - 3.6)

Unit 2: Part 2(5): (5.1, 5.2, 5.3, 5.4 (5.4.1, 5.4.2), 5.5, 5.6) Part 2(6): (6.1-6.3)

Unit 3: Part 2(7) :(7.1, 7.2, 7.4-7.10) Part 2(8): (8.1)

Unit 4: Part 3(9): (9.1 – 9.10) Part 3(10): (10.1-10.6)

Unit 5: Part 3(11): (11.1, 11.3-11.6, 11.8-11.13) Part 4 (12): (12.1- 12.6)

Reference Book

1. H. M. Deitel, "Operating Systems", Pearson, 1990. (Second Edition)
2. Andrew S. Tanenbaum, "Modern Operating Systems", PHI Learning Private Limited, 2013. (Third Edition)
3. Prdeep K. Sinha, "Distributed Operating Systems Concepts and Design", PHI Learning Private Limited, 2014

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Comprehend the history of OS and learn the mechanism and functioning of OS fundamentals	K1,K2	LO
CO2:	Illustrate the concept of Deadlock management, Scheduling and memory management	K3	IO
CO3:	Evaluate the functioning of the OS	K4,K5, K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	M	-	-	-	S	-	S	-	M	-
CO2	S	M	S	-	-		L	-	M	-	S	-
CO3	S	M	S	-	-	-	M	-	M	-	S	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C11 **Credits 4**

SOFTWARE ENGINEERING

Course Objective

- A general understanding of software process models such as the waterfall and evolutionary models.
- To recognize the role of project management including planning, scheduling, risk management, etc.
- Understanding of approaches to verification and validation including static analysis, and reviews.
- Acquaintance of basic SW engineering methods and practices, and their appropriate application.
- Understanding of software evolution and related issues such as quality management.

Syllabus

Unit – I:

Software and Software Engineering:–The Nature of Software–Software–The Unique Nature of Web Apps- Software Engineering –The Software Process- Software Engineering Practice- Software Myths- Process Models:– A Generic Process model- Process- Process Assessment And Improvement- Prescriptive Process Models- Specialized Process Models-the Unified Process- Personal And Team Process Models- Process Technology-Agile Development- What Is Agility?- Agility And The Cost Of Change- What Is An Agile Process?- Extreme Programming (XP)- Other Agile Process Models. *Case Study*: Add two additional myths to the list. Also state the reality that accompanies the myth.

Unit – II:

Principles That Guide Practice:- Software Engineering Knowledge- Core Principles- Principles That Guide Each Framework Activity- Understanding Requirements:- Requirements Engineering- Establishing the Groundwork- Eliciting Requirements- Developing Use Cases- Building the Requirements Model- Negotiating Requirements- Validating Requirements-Requirements

Modeling: Scenarios, Information, and Analysis Classes:- Requirements Analysis- Scenario-Based Modeling- UML Models That Supplement the Use Case- Data Modeling Concepts- Class-Based Modeling-Requirements Modeling: Flow, Behavior, Patterns, And Web apps:- Requirements Modeling Strategies- Flow-Oriented Modeling- Creating a Behavioral Model- Patterns for Requirements Modeling- Requirements Modeling for Web Apps. *Case Study:* Discuss some of the problems that occur when requirements must be elicited from three or four different customers.

Unit III:

Design Concepts:– Design within the Context of Software Engineering- The Design Process- Design Concepts- The Design Model- Architectural Design:- Software Architecture- Architectural Genres- Architectural Styles- Architectural Design- Assessing Alternative Architectural Designs- Architectural Mapping Using Data Flow- Component-Level Design:- What Is a Component?- Designing Class-Based Components- Conducting Component-Level Design- Component-Level Design for Web Apps- Designing Traditional Components- Component-Based Development-User Interface Design:- The Golden Rules- Interface Design Steps- Web App Interface Design- Pattern-Based Design:- Design Patterns- Pattern-Based Software Design- Webapp Design:- Web App Design Quality- Design Goals- A Design Pyramid for Web Apps- Web App Interface Design. *Case Study*: Consider the content object Order, generated once a user of SafeHomeAssured.com has completed the selection of all components and is ready to finalize his purchase. Develop a UML description for Order along with all appropriate design representations.

Unit IV:

Quality Management:– Quality Concepts:- Software Quality- The Software Quality Dilemma- Achieving Software Quality- Review Techniques:- Cost Impact of Software Defects- Defect Amplification and Removal- Review Metrics and Their Use- Informal Reviews- Formal Technical Reviews- Software Quality Assurance:- Elements of Software Quality Assurance- SQA Tasks, Goals, and Metrics- Formal Approaches to SQA- Statistical Software Quality Assurance- Software Reliability- Software Testing Strategies- A Strategic Approach to Software Testing- Strategic Issues- Test Strategies for Conventional Software- Test Strategies for Object- Oriented Software- Test Strategies for Web Apps- Validation Testing- System Testing- The Art of Debugging. *Case Study*: Add two additional questions to each of Garvin‘s quality dimensions.

Unit – V:

Product Metrics: – A Framework for Product Metrics- Metrics for the Requirements Model- Metrics for the Design Model- Design Metrics for Web Apps- Metrics for Source Code- Metrics for Testing- Metrics for Maintenance- Project Scheduling: - Scheduling- Risk Management: - Software Risks- Risk Identification- Risk Projection- EMERGING Trends In Software Engineering:- Technology Evolution- Observing Software Engineering Trends- Identifying ―Soft Trends‖- Technology Directions- Tools-Related Trends. *Case Study*: Select an open-source development effort (other than Linux), and present a brief history of its evolution and relative success.

Text books

1. Roger S.Pressman, ―Software Engineering a Practitioner_s Approach, Seventh Edition, McGraw - Hill Higher Education, 2014. Chapters: 1-17, 23, 27, 28, 31.

   Case Study: - Unit I: Problem 1.11, Unit II: Problem 5.3, Unit III: Problem 13.6, Unit IV: Problem 14.4 Unit V: Problem 31.7.

References

1. IanSomerville, ―Software Engineering, Seventh Edition, Pearson Education, 2005.
2. Richard Fairly,―Software Engineering Concepts‖, TMGH, 2004.
3. Roger S.Pressman, ―Software Engineering a Practitioner_s Approach, Sixth Edition, McGraw - Hill Higher Education, 2006.
4. Rajib Mall, ―Fundamentals of Software Engineering, PHI, Second Edition, 2000.
5. Carlo Ghezzi, Mehdi Jazayeri, Dino Mndrioli,― Fundamentals of Software Engineering, Second Edition, PHI/Pearson Education Asia, 2000

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Learn and summarize the basic concept of SDLC development	K1, K2	LO
CO2:	Design UML Design Documents for a given application	K3	IO
CO3:	Devise fundamental concepts of requirements engineering and Analysis Modeling.	K4,K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	M	M								
CO2	M	M	M	L	S							
CO3	M	M	S	M				S				

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C12 **Credits 3**

COMPUTER NETWORKS

Course Objective

- To designate how computer networks are organized with the concept of layered approach
- Build an understanding of the fundamental concepts of computer networking
- To appraise the contents in a given Data Link layer packet, based on the layer concept.
- Decide routing entries given a simple example of network topology.
- Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Syllabus

Unit- I

Introduction – Network Hardware – Network Software – Reference models: OSI Reference model – TCP/IP Reference model – Network Standardization Physical Layer: Basics of Data Communication – Transmission media – Wireless transmission – Communication Satellites Digital Modulation and Multiplexing – PSTN – Switching.

Unit- II

Data Link layer: Design issues – Error Detection and Correction – Elementary Protocol – Sliding Window Protocol – MAC sub layer: Channel Allocation problem – Multiple Access Protocols – Ethernet – Wireless LAN – Bluetooth – Case Study: Calculation of CRC.

Unit- III

Network Layer: Design Issues – Routing algorithms – Congestion control algorithm - Quality of Service – Internetworking – Network Layer in the Internet – Case Study: Router forwarding.

Unit-IV

Transport Layer: Transport Service – Elements of Transport Protocol – Congestion control - Internet Transport Protocols: UDP – TCP – Delay Tolerant Networking (DTN) – Case Study: Simple Protocol Program for FSM.

Unit- V

Application Layer: DNS – Electronic mail – WWW – Streaming Audio and Video – Content delivery – Cryptography and Network Security: Introduction – Confidentiality – Case Study: Program for RSA Cryptosystem.

Text Book

1. Andrew S Tanenbaum, and David J Wetherall, —Computer Networks, Fifth Edition, Pearson Education, 2014.
   Unit – I (Chapter: 1, 2), Unit – II (Chapter: 3, 4(4.1-4.6)), Unit – III (Chapter: 5), Unit – IV (Chapter: 6), Unit – V (Chapter: 7, 8)

2. B.A. Forouzan, —Data Communication and Networking, Fifth Edition, McGraw Hill, 2013. Unit – V (Chapter: 31),Case Study: (Page. No: 292 - Prg.10-1), (Page. No: 560 - Prg.18-4),(Page. No: 733 - Prg.23-1), (Page. No: 1122 - Prg.31-3).

Reference

1. B.A. Forouzan and Firouz Mosharraf —Computer Networks – A Top – down approach, McGraw Hill, 2012.

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Recognize the hardware, software components of a network and the interrelations, Network reference models	K1, K2	LO
CO2:	Design networks using OSI reference model and the TCP-IP reference model	K3	IO
CO3:	Interpret a suitable routing strategies and manage the networks	K4,K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	M	L	L	L	-	-	-	L	-	-	-
CO2	L	M	L	L	M	-	-	-	L	-	-	-
CO3	S	S	S	L	S	-	-	L	M	-	-	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C13 **Credits 2**

OPERATING SYSTEMS – LAB

Course Objective

- To learn basic knowledge of computer operating system structures and functioning
- To gain insight on to the shell program by learning shell script.

List of Programs

Operating System Concepts:

1. Implementation of Process Creation
2. Implementation of Message Communication
3. Implementation of Round Robin Scheduling algorithm
4. Implementation of FCFS scheduling algorithm
5. Implementation of Shared Memory Client/ Server techniques
6. Implementation of Priority Scheduling algorithm
7. Implementation of Paging algorithm
8. Implementation of Semaphore (Producer _Consumer Process)

Shell script

1. Implementation of File status test command.
2. Implementation of Student Grading Process
3. Implementation of Menu driven Program
4. Implement the Menu driven shell program to perform the following :
    a. Enter the sentence in file.
    b. Search a whole word in an existing file.
    c. Quit.

5. Develop shell program using 3 arguments to take the pattern as well as input and output file names. If the pattern is found display ―Pattern found‖, else display ―Error message, also check if right number of arguments are entered.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Develop the Process Creation and analyze message passing mechanism among processes	K3	IO
CO2:	Prioritize and simulate CPU Scheduling Algorithms like FCFS, Round Robin	K4,K5,K6	HO
CO3:	Implement memory management schemes	K1, K2	LO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	L	S	M	M	L	L	L		
CO2	S	M	M	S	S	M	S	L	L	L		
CO3	S	S	S	S	S	M	M	L	L	M		

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C14 **Credits 2**

RDBMS LAB

Course Objective

- Design and implement a RDMS concept for a given problem-domain
- To understand and use data manipulation language to query, update, and manage a database
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

List of Exercises

RDBMS

1. Design a calculator.
2. Simple program using menu Design.
3. Simple program using Timer Control.
4. Simple programs with classes and objects
5. Preparation of student mark list
6. Railway Reservation system
7. Handling Events
8. Creation of ActiveX controls
9. Simple Animations

Oracle

1. Simple Queries using DDL, DML, base Tables.
2. Simple Queries using DDL, DML base Views.
3. Column Reports Creation.
4. PL/SQL Procedures Creation.
5. Database Triggers Creation.
6. Reports Creation.
7. Built-in Functions.

Course outcome

- Populate and query a database using SQL DML/DDL commands.
- Declare and enforce integrity constraints on a database using RDBMS.
- Programming PL/SQL including stored procedures and cursors

On the successful completion of the course, students will be able to:

CO1:	Design Front End UI using Visual Basics(VB)	K1, K2	LO
CO2:	Develop simple applications in VB and Oracle using ADO database connectivity	K3	IO
CO3:	Create new user defined controls in VB	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	-	L	-	-	-	-	-
CO2	S	M	M	L	L	-	L	-	-	-	-	-
CO3	S	L	S	M	L	-	L	-	-	-	-	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C15 **Credits 1**

FINANCIAL COMPUTING-LAB

Course Objective

- To comprehend the basic principles of double entry system and preparation of balance sheet
- To prepare the appraisal for various business activities such as purchase, sale, production profit and loss
- To ensure decision making process of an organization

List of Exercises

1. Create a Single Ledger using display and alter commends
2. Create a Multiple Ledger using display and alter commends
3. Create Single group using display and alter commends
4. Create a multiple groups using display and alter commends
5. Create a voucher types like contra, credit & debit notes, purchase, sales, receipt and delivery notes.
6. Create a single stock group.
7. Create a multiple stock groups
8. Create balance sheet for various items
9. Create profit and loss account for various aspects
10. Prepare various types of vouchers like accounting, inventory, and import transaction

Course outcome

On the successful completion of the course, students will be able to

CO1:	Defend Financial Statement Analysis for the given Balance sheet	K1,K2	LO
CO2:	Summarize the various sources of finance In Financial Management	K3	IO
CO3:	Correlate Journal, ledgers and Trail Balance for various Transaction	K4, K5, K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	S	S	-	S	M						
CO2	S	M					M		M			
CO3	M	M	M									

S- Strong; M-Medium; L-Low

Semester - III

Course Code-18UPCSC1C16 **Credits 4**

JAVA PROGRAMMING

Course Objective

- To gain knowledge of object-oriented paradigm in the Java programming language
- Comprehend fundamentals of classes, invoking methods, using class libraries, etc.
- To design and program stand-alone Java applications
- Learn how to use AWT and Java beans
- To apprehend how to connect relational database to Java

Syllabus

Unit-I

An Overview of Java: Object Oriented Programming-Lexical Issues- class Libraries. Data Types, Variables, and Arrays: Primitive Types-Literals-Variables-Type Conversion and Casting- Arrays. Operators: Arithmetic-Bitwise – Relational - Boolean Logical Assignment – Conditional - operator Precedence. Control Statements: Selection statements-Iteration Statements-Jump Statements. Classes and Methods: Fundamentals Declaring objects- Methods-Constructors-Garbage Collection- Overloading Methods Recursion – Access Control- Nested and Inner Classes- Command Line Arguments.

Unit-II

Inheritance: Basics- Super Class- Method overriding- Abstract Class. Packages and Interfaces: Packages- Access Protection-Importing Packages-Interfaces- Default Interface Methods. Exception Handling: Fundamentals-types- Uncaught Exceptions- Try and Catch- throw-throws-finally-built-in

exceptions. Multi- threaded programming: Thread Model-Creating a Thread-Thread Priorities-Synchronization-Inter thread Communication.

Unit-III

String Handling: Constructors- Length - Special String Operations - Character Extraction - String Comparison - Modifying a String - String Buffer. Input/Output: The I/O Classes and Interfaces – File - I/O Exceptions - Byte Streams - Character Steams – Serialization. The Applet Class: Basics-Architecture - Applet Skeleton - Display methods - Status Window - Passing Parameters. Event Handling: Event Model – Classes – Key Event Class- Event Listener Interfaces.

Unit-IV

AWT: Window Fundamentals - Working with Frame Windows – Graphics - Working with Color Working with fonts - Controls – Labels- Buttons- Check Box - Choice Controls- Lists- Scroll Bars- Text Field- Text Area - Layout Menu bars and Menus. Java Beans: Advantages - Introspection – properties - Java Beans API. Servlets: Life Cycle Simple Servlet-Servlet API-Packages-Cookies-session tracking.

Unit-V.

Using Relational Databases: Introduction- JDBC Drivers for RDBM Systems - Using Java.sql API Using Javax.sql API - Connection Pooling. Network Programming: Introduction- Working with URLs- Working with Sockets-Remote Method Invocation.

Text Book

1. Herbert Schildt, “The Complete Reference Java J2SE”, 9th ed., TMH Publishing Company Ltd, New Delhi, 2014. Chapter: 2-11, 16, 22, 23, 24, 25, 26, 37,38
2. Joe Wiggles worth and Paula McMillan, “Java Programming Advanced Topics”, 3rd ed., 2001, TMH, Chapter: 9,11

Reference Book

1. John Dean, Raymond Dean, "Introduction to Programming with JAVA – A Problem Solving Aproach", Tata McGrawHil,2012
2. Ralph Bravaco, Shai Simonson, "Java Programming: From the Ground Up", Tata McGraw Hil Edit on, 2012
3. Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", Tata McGrawHil, 2013

Outcomes:

- Make use of hierarchy of Java classes to provide a solution to a given set of requirements found in the Java API
- Develop Client-Server Applications with Database Maintenance.
- Able to develop a Graphical User Interface (GUI) with Applet and AWT.
- Design and implement server side programs using Servlets and JSP

On the successful completion of the course, students will be able to:

CO1:	Summarize the Object Oriented Programming, Operators, classes and methods	K1,K2	LO
CO2:	Design and Develop the program using concepts of Inheritance, Exception Handling, Multi- threaded programming, AWT, Applet, Servlet	K4,K5,K6	IO
CO3:	Apply the OOPs concept and String Handling for the real time programs	K3	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	-	L	-	-	-	-	-
CO2	S	M	M	L	L	-	L	-	-	-	-	-
CO3	S	L	S	L	L	-	L	-	-	-	-	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C17 **Credits: 4**

DISCRETE MATHEMATICS

Course Objective

- Simplify and appraise basic logic statements including compound statements, implications, inverses, converses, and contrapositives using truth tables and the properties of logic
- Apply the operations of sets and use Venn diagrams to solve applied problems; solve problems using the principle of inclusion-exclusion.
- To gain knowledge about lattices and graph

Syllabus

Unit-I

Well formed formulas – truth table of well formed formula – tautology, contradiction and contingency –equivalence of formulas. Algebra of propositions – Functionality complete sets – Normal forms of well formed formulas- Rules of Inference for propositional calculus – well formed formulas of predicate calculus – Rules of Inference for predicate calculus – predicate formulas involving two or more quantifiers.

Unit-II

Set theory – set identities – relations-Binary relations – properties of binary relations in a set – Equivalence relations and partial orderings – Representation of a relation by a matrix representation of a relation by a digraph - Basics of Counting – Integers and Induction- functions.

Unit-III

Formulation as Recurrence Relations-solving recurrence Relation by Iteration-solving Recurrence Relations- Solving Linear Homogeneous Recurrence Relations of Order Two-Solving Linear Non homogeneous Recurrence Relations. Permutations-Combinations-Permutations with repetitions-

Combinations with repetition-permutations of sets with indistinguishable objects.

Unit-IV

Definition and examples-properties of lattices –lattices as algebraic systems-Sub lattices and lattice Isomorphism-special classes of lattice –distributive lattices and Boolean algebras.

Unit-V

Connected Graphs-Euler Graphs-Hamiltonian circuits and paths – planar graphs – matrix representation of graphs.

Textbook

1. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI Learning Private Limited, New Delhi, 2010.

   Unit-I : (Chapters: 2.1-2.11)
   Unit-II : (Chapters: 1.3-1.7, 4.1-4.2, 5.1-5.5)
   Unit-III : (Chapters: 6.1-6.5, 3.1-3.6)
   Unit-IV : (Chapters: 8.1-8.6)
   Unit-V : (Chapters: 10.1-10.5 and 10.8)

Reference Book

1. J.P.Trembley and R.Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, New Delhi, 1997.
2. T. Sengadir, "Discrete Mathematics and Combinatorics", Pearson New Delhi 2009.
3. RakeshDube ,AdeshPandeyRitu Gupta, "Discrete Structures and Automata Theory", Narosa publishing House New Delhi 2007.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Interpret about the Well formed formula's based on its truth table	K1,K2	LO
CO2:	Collaborate the Set theory, relations and its functions based on set identities and Binary relations	K3	IO
CO3:	Categorize the formulation as Recurrence Relations-solving recurrence Relation by Iteration	K4,K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	S	S	L	S	S	M	S	L	S	-	S	S	S
CO2	S	S	L	S	S	M	S	L	S	-	S	M	S
CO3	S	S	L	S	S	M	S	L	S	-	S	M	S

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C18 **Credits 4**

CRYPTOGRAPHY AND NETWORK SECURITY

Course Objective

- To familiarize classical encryption techniques and advanced encryption standards
- To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms
- To recognize different encryption and decryption techniques to solve problems related to confidentiality and authentication
- To develop the ability to use existing cryptographic utilities to build programs for secure communication.

Syllabus

Unit-I

Overview: Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services – Security Mechanisms –A Model for Network Security – Classical Encryption Techniques: Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines – Steganography.

Unit-II

Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure –The Data Encryption Standard – The DES Example – The Strength of DES – Block Cipher Design Principles –Basic Concepts in Number Theory and Finite Fields: Divisibility and the Division Algorithm – The Euclidean Algorithm – Modular Arithmetic – Groups, Rings, and Fields – Finite Fields of the Form GF(p) – Polynomial Arithmetic.

Unit-III

Advanced Encryption Standard: Finite Field Arithmetic – AES Structure – AES Transformation Functions – AES Key Expansion –Block Cipher Operation:

Multiple Encryption and Triple DES – Stream Ciphers – RC4 – Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems – The RSA Algorithm –Diffe-Hellman Key Exchange – Elgamal Cryptographic System – Elliptic Curve Arithmetic – Elliptic Curve Cryptography – Pseudorandom Number Generation Based on an Asymmetric Cipher.

Unit-IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions – Two Simple Hash Functions – Requirements and Security – Hash Functions Based on Cipher Block Chaining – Secure Hash Algorithm(SHA) – SHA-3 – Message Authentication Codes: Requirements – Functions – Security of MACs – MACs Based on Hash Functions: HMAC – MACs based on Block Ciphers: DAA and CMAC – Authenticated Encryption: CCM and GCM – Key Wrapping.

Unit-V

Digital Signatures – Elgamal Digital Signature Scheme – Schnorr Digital Signature Scheme – NIST Digital Signature Algorithm – Elliptic Curve Digital Signature Algorithm – RSA-PSS Digital Signature Algorithm – Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption – Symmetric Key Distribution Using Asymmetric Encryption – Distribution of Public Keys – X.509 Certificates – Public-Key Infrastructure.

Text Book

1. William Stallings, "Cryptography and Network Security – Principles and Practices" Pearson Education / PHI, 6th Edition, 2014.
   Chapters: 1.1 – 1.6, 2.1 – 2.5 (UNIT-I), 3.1 – 3.5, 4.1 – 4.6 (UNIT-II), 5.1 - 5.4, 6.1, 7.4, 7.5, 9.1, 9.2, 10.1-10.5 (UNIT-III), 11.1-11.6, 12.1, 12.2, 12.4 – 12.8 (UNIT-IV), 13.1-13.6, 14.1-14.5 (UNIT-V)

Reference Books

1. Bernard Menezes, "Network Security and Cryptography", Cengage,1stEdition, 2010.
2. William Stallings, "Cryptography and Network Security", Pearson Education India, Sixth Edition, 2016.
3. V.K. Jain, "Cryptography and Network Security", Khanna Book Publishing- New Delhi, 2016.
4. C.K. Shyamala, N. Harini, Dr. T. R. Padmanabhan, "Cryptography and Security", Wiley India Pvt. Ltd., 2011.

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Comprehend the basics of network security model and architecture	K1,K2	LO
CO2:	Apply different cryptographic operations of symmetric cryptographic algorithms	K3	IO
CO3:	Improve the cryptographic algorithms for the dynamic problems	K4,K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	-	L	M	L	M	M	-	M	-	-
CO2	M	S	-	L	M	L	M	M	-	M	-	-
CO3	M	S	-	L	M	L	M	M	-	M	-	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C19 **Credits 2**

JAVA PROGRAMMING LAB

Course Objective

- To implement object oriented concepts in JAVA
- To recognize the implementation of AWT, Swing, Servlets and RMI
- To deepen student's programming skills by analyzing the real world problem in a programmer's point of view and implement the concepts in real time projects
- To enable the students to learn the ethical, historical, environmental and technological aspects of Advanced Java Programming and how it impacts the social and economic development of society

List of programs

1. Write a Program to implement class and objects.
2. Write a program to implement method overloading.
3. Write a program to implement method overriding.
4. Design a package to prepare a pay slip using multiple inheritance.
5. Implementation of Multi-threading and Exception handling concepts
6. Implementation of I/O Streams
7. Write programs using AWT, Swing and Event handling
8. Implement message communication using Network Programming.
9. Write a program to connect databases using JDBC
10. Implementation of Servlets /JSP

Outcomes

- Apply object-oriented concepts to design and develop applications
- Create a basic website using HTML and Cascading Style Sheets
- Design front end web page and connect to the back end databases
- Applying different event handling mechanisms. Make use of hierarchy of Java classes to provide a solution to a given set of requirements found in the Java API

On the successful completion of the course, students will be able to:

CO1:	Implement the java program using class and objects	K1,K2	LO
CO2:	Illustrate the implementation of I/O Streams	K3	IO
CO3:	Analyse the real world problems and develop java based solutions	K4,K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	-	L	-	-	-	-	-
CO2	S	M	M	L	L	-	L	-	-	-	-	-
CO3	S	L	S	S	L	-	L	-	-	-	-	-

S- Strong; M-Medium; L-Low

COURSE - 18UPCSC1C20 **Credits: 2**

WEB TECHNOLOGY LAB (OPEN SOURCE LAB)

Course Objective

- This course objective is to apply open source concepts to design and develop applications
- It enables the student to create a basic website using HTML , Cascading Style Sheets , Java API, Event Handling and dynamic based web applications

List of Programs

1. Write an HTML code to create your Institute website, Department Website and Tutorial Website for specific subject.
2. Write an XML file which will display the book information which includes the Title of the book, Author name, ISBN Number, Publisher name, Edition, price.
3. Write a program using PHP and HTML to create a form and display the details entered by the user.
4. Embedding Video and Audio Files in HTML
5. Write an XML document to display your bio-data. Write an XSL style sheet and attach that to the XML document. Validate the document using DTD or XSD.
6. Write a program to redirect, popup and print function in JavaScript.
7. Design Image Mapping using Java Script
8. Simple Game using Event handling in Java Script
9. Develop a Web Application for Airline reservation System using PHP and AJAX
10. Online shopping cart with Table operations (Insert, Select, Delete, Update) using PHP

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Understand the open source components for developing the web applications	K1, K2	LO
CO2:	Develop Web pages using HTML , CSS, JAVA based web pages	K3	IO
CO3:	Create and evaluate the web application using open source technology	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	-	L	-	-	-	-	-
CO2	S	M	M	L	L	-	L	-	-	-	-	-
CO3	S	L	S	S	L	-	L	-	-	-	-	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C21 **Credits 2**

SOFT SKILL DEVELOPMENT LAB

Course Objective

- This course provides opportunities to students to develop and demonstrate basic communication skills in technical, professional and social contexts effectively.

List of Programs

1. Characteristics of Technical Writing
2. Development of Employability Skills
3. Vocabulary Development
4. Sentence Completion
5. Error Spotting
6. Interpretation of Verbal Analogy
7. Interpretation of Reading (Comprehension - Conception)
8. Interpretation of Reading (Comprehension - Reasoning)
9. Practice for writing E-mails/Technical Blogs/Forums
10. PPT Preparation / Demonstration of Technical Presentation
11. Preparation of Resume
12. Preparation for Job Interviews / Mock Interview Section
13. Group Discussion Skills
14. Developing Listening Skill (Comprehension)
15. Practice for Short Speeches / Situational Conversation

Reference Books

1. Courseware on "Technical Communication for Scientists and Engineers", IIT Bombay, 2015.
2. Cappel, Annette and Sharp, Wendy, Cambridge English: Objective First, 4th Ed., CUP, New Delhi, 2013.
3. Sue Prince, Emma, The Advantage: The 7 Soft Skills You Need to Stay One Step Ahead, Pearson; 1 Edition, 2013.
4. Hart, Guy Brook, Cambridge English Business Benchmark: 2 Ed., CUP 2014
5. Lewis, Norman. How to Read better & Faster. New Delhi: Binny Publishing House. 1978
6. McCarthy, Michael and Felicity O'Dell.. English vocabulary in use: 100 Units of Vocabulary reference and practice. Cambridge: CUP. 1996

Course Outcomes

On the successful completion of the course, students will be able to

CO1	To Plan, organise, and present technical articles in the frame of the scientific method	Apply
CO2	To Develop Business communication skills in corporate environment	Apply
CO3	Apply their interpersonal skills in technical, professional and social contexts	Apply

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								M	M	M	L	M
CO2								M	M	M	L	M
CO3								M	M	M	L	M

S- Strong; M-Medium; L-Low

Semester-IV

Course Code-18UPCSC1C22 **Credits 4**

DATA MINING

Course Objective

- Identify appropriate data mining algorithms to solve real world problems
- To evaluate data, choose relevant models and algorithms for respective applications
- Learn popular distance-based partitioning algorithms for cluster analysis, including K-Means, K-Medians, and K-Medoids algorithms.
- To describe complex data types with respect to spatial and web mining

Unit I

INTRODUCTION TO DATA MINING: Data miners-The Need for Human Direction of Data Mining-The Cross-Industry Standard Process for Data Mining: CRISP-DM- CRISP-DM: The Six Phases -Fallacies of Data Mining –Data Preprocessing :Data Cleaning-Handling Missing Data-Identifying Misclassification-Data Cleaning - Handling Missing Data- Identifying Misclassifications-Graphical Methods for Identifying Outliers -Measures of Center and Spread - Data Transformation-Min–Max Normalization- Z-Score Standardization - Decimal Scaling- Transformations to Achieve Normality-Numerical Methods for Identifying Outliers - Flag Variables - Transforming Categorical Variables into Numerical Variables- Binning Numerical Variables-Reclassifying Categorical Variables-Adding an Index Field - Removing Variables that are not Useful - Variables that Should Probably not be Removed- Removal of Duplicate Records.

Unit II

DIMENSION –REDUCTION METHODS: Need for Dimension-Reduction in Data Mining- Principal Components Analysis-Applying PCA to the Houses Data Set-The Eigenvalue Criterion - The Proportion of Variance Explained Criterion- The Minimum Communality Criterion- The Scree Plot Criterion-Profiling the Principal Components- Communalities-Minimum Communality Criterion-

Validation of the Principal Components-Factor Analysis-Applying Factor Analysis to the Adult Data Set- Factor Rotation- User-Defined Composite.

Unit III

K-NEAREST NEIGHBOR ALGORITHM: Classification Task- k-Nearest Neighbor Algorithm-Distance Function - Combination Function-Simple Unweighted Voting-Weighted Voting-Quantifying Attribute Relevance: Stretching the Axes-Database Considerations-k-Nearest Neighbor Algorithm for Estimation and Prediction- Choosing k -Application of k-Nearest Neighbor Algorithm Using IBM/SPSS Modeler-Decision Tree: Requirements for Using Decision Trees-Classification and Regression Trees- C4.5 Algorithm- Decision Rules-Comparison of the C5.0 and CART Algorithms Applied to Real Data.

Unit IV

CLUSTERING: The Clustering Task - Hierarchical Clustering Methods-Single-Linkage Clustering- Complete-Linkage Clustering - k-Means Clustering-Example of k-Means Clustering at Work-Behavior of MSB, MSE, and Pseudo-F as the k-Means Algorithm Proceeds-Application of k-Means Clustering Using SAS Enterprise Miner-Using Cluster Membership to Predict Churn-MEASURING CLUSTER GOODNESS: Rationale for Measuring Cluster Goodness-The Silhouette Method - Silhouette Example - Silhouette Analysis of the IRIS Data Set-The Pseudo-F Statistic-Example of the Pseudo-F Statistic - Pseudo-F Statistic Applied to the IRIS Data Set - Cluster Validation- Cluster Validation Applied to the Loans Data Set.

Unit V

ASSOCIATION RULES-Affinity Analysis and Market Basket Analysis-Data Representation for Market Basket Analysis-Support, Confidence, Frequent Itemsets, and the a Priori Property-Generating Frequent Itemsets- Generating Association Rules-Extension from Flag Data to General Categorical Data-Information-Theoretic Approach: Generalized Rule Induction Method-J-Measure-Association Rules are Easy to do Badly-- Local Patterns Versus Global Models- Case Study: Business understanding, Data Preparation and EDA.

Text Book

1. Daniel T. Larose , Chantal D. Larose, Data mining and Predictive analytics, Second Ed., Wiley Publication, 2015. (Chapters: 1, 2, 4, 10, 11, 19, 22, 23, 29).

Reference Book

1. David L. Olson DursunDelen , Advanced Data Mining Techniques, Springer-Verlag Berlin Heidelberg, 2008
2. Jiwei Han, MichelienKamber, "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers an Imprint of Elsevier, 2006.
3. John Wang, Encyclopedia of Data warehousing and Mining, Idea Group Publishing, 2005.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand and Extract knowledge using the concept of data processing and data mining	K1-K2	LO
CO2:	Apply various data mining principles and Algorithms for Information Retrieval from the dataset	K3	IO
CO3:	Analyze and summarize various data mining functionalities	K4-K5	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	M	-	-	M	-	M	-	L	-
CO2	S	M	M	M	-	-	M	-	S	-	S	-
CO3	S	S	S	S	-	-	M	-	M	-	M	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C23 **Credits 4**

DOT NET PROGRAMMING

Course Objective

- To enable the students to learn the fundamental concepts of VB.NET
- Able to develop web applications server-side technologies with ASP.NET, and ADO.NET.
- To gain knowledge of Dot Net Frameworks along with C#
- Learn to write object-oriented logic using C#

Syllabus

Unit-I

Introduction to .NET-VB and VB.NET differences –Data types-Variables-Operators-Arrays-Conditional Logic

Unit-II

Procedures-Dialog Boxes-File IO and System Objects-Error Handling-Namespace-Classes and Objects

Unit-III

Introduction to Data Access in .NET-ADO.NET-Data Access in Visual Studio.NET-Windows Forms: Controls-Specific Controls

Unit-IV

Introduction to Web Development-ASP.NET-Page Framework-HTML Server controls-Web controls

Unit-V

Validation controls-User controls-Events-Cascading Style Sheets-State Management-Asp.Net Applications-Tracing-Security

Text Book:

1. Bill Evjen Janson Beres et al., “Visual Basic .Net Programming Bible”, 2014. (Chapters : 1, 2, 5, 6, 7, 8, 9, 10, 12, 13, 14, 21, 22, 23, 25, 26, 27, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43)

Reference Books:

1. Jason N.Gaylord, Christian Wenz, Pranav Rastogi, Todd Miranda, Scott Hanselman, Scott Hunter, "Professional ASP.NET 4.5 in C# and VB"- 2013.
2. Bill Evjen, Scott Hanselman, Devin Rader, "Professional ASP.NET 3.5 SPI Edition: in C# and VB- 2009.
3. Thearon willis, Jonathan Crossland Blair ,"Beginning VB .NET 2003",Wiley Dreamtech Publishers, 2004.

On the successful completion of the course, students will be able to:

CO1:	Understand and learn .Net Framework	K1-K2	LO
CO2:	Apply the concepts to develop the applications for real-time problem in VB.Net and ASP.Net	K3	IO
CO3:	Analyze the feasibility of using .Net for real time problems	K4-K5	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	S	L	-	L	-	-	-	-	-
CO2	S	M	M	L	L	-	L	-	-	-	-	-
CO3	S	L	S	M	M	-	M	-	-	-	-	-

S- Strong; M-Medium; L-Low

COURSE- 18UPCSC1C24 **Credits: 4**

Computer Vision

Course Objective

- This course aims to provide complete knowledge on Computer Vision Concepts. It elaborates the how to perform evaluation of Image Processing Algorithms and models.
- To implement and apply Image Processing Methods to real-world applications.
- To identify and apply the Image Processing Techniques in different diagnostics diseases.

Syllabus

Unit–I

Fundamentals: Image Sensing and Acquisition, Image Sampling and Quantization, relationship between Pixels; Random noise; Gaussian Markov Random Field, σ-field, Linear and Non-linear Operations; Image processing models: Causal, Semi-causal, Non-causal models. Color Models: Color Fundamentals, Color Models, Pseudo-color Image Processing, Full Color Image Processing, Color Transformation, Noise in Color Images.

Unit – II

Spatial Domain: Enhancement in spatial domain: Point processing - Mask processing - Smoothing Spatial Filters - Sharpening Spatial Filters - Combining Spatial Enhancement Methods - Frequency Domain - Image transforms – FFT – DCT – Karhunen - Loeve transform - Hotlling's T2 transform - Wavelet transforms and their properties - Image filtering in frequency domain.

Unit – III

Edge Detection: Types of edges – threshold - zero-crossing - Gradient operators: Roberts – Prewitt - and Sobel operators - residual analysis based technique - Canny edge detection - Edge features and their applications.

Unit – IV

Image Compression: Fundamentals, Image Compression Models - Elements of Information Theory. Error Free Compression: Huff-man coding - Arithmetic coding - Wavelet transform based coding - Lossy Compression: FFT – DCT – KLT – DPCM - MRFM based compression - Wavelet transform based - Image Compression standards.

Unit –V

Image Segmentation: Detection and Discontinuities: Edge Linking and Boundary Deduction; Threshold; Region-Based Segmentation - Segmentation by Morphological watersheds - The use of motion in segmentation - Image Segmentation based on Color - Morphological Image Processing: Erosion and Dilation - Opening and Closing - Hit-Or-Miss Transformation - Basic Morphological Algorithms - Gray-Scale Morphology. Computer Vision: Introduction – The image representations and properties.

Text Books

1. Rafael Gonzalez, Richard E. Woods, "Digital Image Processing", Fourth Edition, PHI/Pearson Education, 2013.

Unit–I (Chapters: 2.3-2.5, 6.1-6.5,6.8)

Unit – II (Chapters:3.5-3.7,4.11.3)

Unit – IV (Chapters:8.1,8.1.6,8.2.1,8.2.3,8.2.10,8.1.7)

Unit – V(Chapters:10.2.2,10.2.7,10.3,10.4,10.5,10.6,6.7,9.2-9.6,12.2-12)

2. A. K. Jain, Fundamentals of Image Processing, Second Ed., PHI, New Delhi, 2015.

Unit – II (Chapters:7.2)

Unit – III (Chapters:9.4)

3. Sonka, Hlavac, Boyle, "Digital Image Processing and Computer Vision", CENGAGE Learning, INDIA EDITION, 2009.

Unit – V (Chapters:1,2)

Reference Books

1. B. Chan la, D. Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2003.

2. Nick Elford, “Digital Image Processing a practical introducing using Java”, Pearson Education, 2004.

3. Todd R.Reed, “Digital Image Sequence Processing, Compression, and Analysis”, CRC Press, 2015.

4. L.Prasad, S.S.Iyengar, “Wavelet Analysis with Applications to Image Processing”, CRC Press, 2015

Course outcome

On successful completion of the course, the students will

CO1:	To understand the fundamental concepts of a digital image processing system and Analyze images using various transforms.	K1-K2	LO
CO2:	To apply the Image Processing Techniques such as image compression and image enhancement in different diagnostics diseases and other real time applications	K3	IO
CO3:	Interpret Image compression standards, and Interpret image segmentation and representation techniques.	K4-K5	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	M	-	-	M	-	M	-	L	-
CO2	S	L	S	S	-	-	S	-	S	-	S	-
CO3	S	M	M	M	-	-	M	-	S	-	S	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C25 **Credits: 1**

DATA MINING LAB (USING PYTHON)

Course Objective

- To learn the basics of Python programming
- To emphasis the Object Oriented Programming using Python
- To establish Network Programming in Python

List of Programs

1. Programs using elementary data items, lists, dictionaries and tuples.
2. Programs using if, elif, else, while and for loop.
3. Programs using while.
4. Programs using for loop.
5. Programs using functions
6. Programs using exception handling
7. Programs using command line arguments and import statements
8. Programs using classes and objects
9. Programs using modules.
10. Programs for creating dynamic and interactive web pages using forms.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To comprehend the concepts of Python	K1-K2	LO
CO2:	Design real life situational problems and think creatively about solutions of them.	K3	IO
CO3:	Appraise the best features Programs for creating dynamic and interactive web pages using forms.	K4-K5	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	M	M	-	-	S	S	-	S	M
CO2	S	M	S	S	S	-	-	S	S	-	M	M
CO3	S	S	S	S	S	-	-	M	M	-	S	M

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C26 **Credits 4**

DOT NET PROGRAMMING LAB

Course Objective

- Design and implement .NET framework and Windows applications
- To develop user interactive web pages using ADO.NET
- To design a data binding applications using ADO.Net connectivity.

Implement the following using VB.NET

1. Creating and using Variables, Arrays and Structure
2. Creating and using Procedures
3. Using Decision Structures
    a. Checking User Input
    b. Confirming Application Close
4. Implementing Structured Exception Handling
5. Creating Menus , Status Bars and Toolbars
6. Create, read, update, and delete records in a database using ADO.NET

Implement the following using C#.NET

7. Create a master page to serve as a template for the Web site's pages.
8. Create an admin page with an editable master-detail view for browsing, inserting, updating, and deleting records.
9. Create a simple web site
10. Create a feedback form.

Course outcome

On the successful completion of the course, students will be able to:

CO1:	To understand the concepts of .net framework and programming style	K1-K2	LO
CO2:	Design and develop the solutions for real life situational problems using VB.Net and ASP.Net	K3	IO
CO3:	Evaluate the Programs for creating dynamic solutions	K4-K5	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S	L	S	-	L	-	-	-	-	-
CO2	S	M	M	L	S	-	L	-	-	-	-	-
CO3	S	L	S	M	M	-	M	-	-	-	-	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C27 **Credits: 2**

MOBILE APPLICATION DEVELOPMENT LAB

Course Objective

- To enable the students practice the concepts of Mobile application and develop solutions for real world problems.
- Understand how to work with various mobile application development frameworks
- Comprehend the capabilities and limitations of mobile devices.

List of programs

1. Implement the WML tags and Image using WML/J2ME
2. Design of simple Calculator having +, -, * and / using WML/J2ME
3. Design of Calendar for any given month and year using WML/J2ME
4. Design a Timer to System Time using WML/J2ME
5. Design of simple game using WML/J2ME
6. Animate an image using WML/J2ME
7. Design a personal phone book containing the name, phone no., address, e-mail, etc
8. Simulation of Authentication and encryption technique used in GSM
9. Browsing the Internet using Mobile phone simulator
10. Implement the Node Aggregation using GlomoSim

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Practical knowledge of mobile application development for the Windows platform	K1-K2	LO
CO2:	Design real life situational problems and think creatively about solutions of them.	K3	IO
CO3:	Appraise the best features Programs for creating dynamic and interactive web pages using forms.	K4-K5	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	S	S						
CO2	S	M	S	S	M	M						
CO4	S	S	S	S	S	M						

S- Strong; M-Medium; L-Low

Semester-V

COURSE - 18UPCSC1C28 **Credits: 4**

BIG DATA ANALYTICS

Course Objective

- To understand the basic concepts of big data
- To learn Hadoop, MapReduce, Hive, HBase and Pig

Syllabus

Unit I

Fundamentals of Big Data Understanding Big Data: Concepts and Terminology – Big Data Characteristics – Types of Data – Case Study Background – Drivers for Big Data Adoption: Information and Communication Technology – Big Data Analytics Lifecycle

Unit II

Fundamentals of Hadoop Core components of Hadoop- Apache Hadoop – HDFS Daemons – MapReduce Daemons – HDFS High Availability Daemons – Benefits and Challenges of HDFS – File Sizes, Block Sizes and Block Abstraction in HDFS – Data Replication – How does HDFS Store, Read, and Write Files? – Data Serialization Options – File System Shell Commands for HDFS

Unit III

HDFS and MapReduce Choosing Key and Value Types for MapReduce Jobs – The Relationship of Input Keys to Output Keys – Sorting Keys and Values – Sort and Shuffle Process – MapReduce Job Configuration and Submission Hadoop Distributed File System – MapReduce Framework – Setting the Environment – Hadoop Cluster Modes – Running a MapReduce Job with the

MR1Framework - Running a MapReduce Job with the Yarn Framework – Running Hadoop Streaming

Unit IV

Hive and HBase Apache Hive: Setting the Environment – Configuring Hadoop, Hive – Starting HDFS, Hive Server, CLI – Creating and Using a Database– Creating a Managed Table – Loading data into a Table – Creating a Table using LIKE – Adding Data into a Table from Queries – Adding Data using INSERT INTO TABLE - Adding Data using INSERT OVERWRITE – Creating a table using CREATE TABLE AS SELECT – Altering, Truncating and Dropping a Table– Creating an External Table – Apache HBase: Setting the Environment - Configuring Hadoop, Hive and HBase – Starting the HBase and HBase Shell – Creating HBase Table – Adding Data to a Table – Listing all Tables – Getting a Row of Data – Scanning a Table – Counting the Number of Rows in a Table – Altering a Table – Deleting a Table Row, Column – Disabling and Enabling a Table – Truncating and Dropping a Table – Determining If Table Exists – Creating a Hive External Table stored by HBase

Unit V

Pig Introduction – Installing and Running Pig – Grunt – Pig's Data Model – Introduction to Pig Latin – Advanced Pig Latin – Developing and Testing Pig Latin Scripts – Making Pig Fly – Writing Evaluation and Filter Functions – Writing and Loading Store Function

Text Books

1. Alan Gates, "Programming Pig", Oreilly Publication, 2011.
2. Deepak Vohra, "Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools", Apress, 2016.
3. Thomas Erl, Wajid Khattak, Paul Buhler, "Big Data Fundamentals Concepts, Drivers & Techniques", Service Tech Press, 2015.

Reference Book

1. Noreen Burlingame , "The little book on Big Data", New Street publishers, 2012.
2. Anil Maheshwari, " Data Analytics", McGraw Hill Education, 2017.

Course Outcomes

- On the successful completion of the course, students will be able to

CO1:	To understand the Data Science, Overview of Big Data Analytics, Big Data Evolution, and Data Analytics Life Cycle	K-1K2	LO
CO2:	To apply parallel and distributed computing for big data in Hadoop	K3	IO
CO3:	To implement data science and big data analytics projects using MapReduce, Pig, HBase, Hive	K4-K5	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	-	-	-	-	L	-	-	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S	S	S

S- Strong; M-Medium; L-Low

Course Code- 18UPCSC1C29 **Credits: 4**

CLOUD COMPUTING

Course Objective

- To provide in-depth knowledge of Cloud Computing concepts, technologies and applications
- To learn how to use Cloud Services.
- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc
- Exploring students to understand mobile web services

Syllabus

Unit I

Introduction – Definition of Cloud – Cloud types – Characteristics of Cloud – Cloud standards– Measuring cloud's value – Early adopters and new applications - Laws of cloudonomics – Cloud obstacles – Cloud adoption – Cloud computing costs – Service level agreements – Licensing model - Cloud architecture: Cloud computing stack – Composability – Infrastructure – Platforms – Virtual appliances – Communication protocol – Applications – Connecting to cloud.

Unit II

Cloud Services: IaaS – PaaS – SaaS – IdaaS – CaaS - Abstraction and Virtualization: Virtualization technologies – Load balancing – Hypervisors – Machine imaging – Porting applications – Capacity planning: Baseline and Metrics – Measurements – System metrics – Load testing – Resource ceilings – Servers and Instance types – Network Capacity – Scaling

Unit III

Exploring Platform as a Service (PaaS) : Service model – Development – Sites and tools – Application features - Exploring Cloud Infrastructures: Administrating the clouds – Management responsibilities – Life cycle management - Cloud management products – Cloud management standards –

Cloud Security: Securing the Cloud – Securing the Data – Establishing identity and presence

Unit IV

Service oriented architecture - Introduction – SOA communications– Managing and Monitoring SOA – Relating SOA and Cloud - Applications to the cloud: Functionality mapping – Applications attributes – Cloud service attributes – System abstraction – Cloud bursting – Applications and Cloud APIs – Cloud Storage: Measuring digital universe – Provisioning cloud storage – Cloud backup solutions – Cloud storage interoperability.

Unit – V

Exploring cloud mail service – Syndicate services – Instant messaging – Collaboration technologies using social networking – Audio and Video streaming – VoIP applications – Mobile market – Smart phones with the cloud - Mobile Web service: Service types – Service discovery – SMS – Protocols – Synchronization

Textbook

1. Barrie Sosinsky, Cloud Computing Bible, Wiley Publications, 2011
   (Unit I to V)

Reference Book

1. Rountree, Castrillo, The Basics of Cloud Computing - Understanding the Fundamentals of Cloud Computing in Theory and Practice, First Edition, Syngress Publication, 2013.
2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, 2008
3. Srinivasan, S, Cloud Computing Basics, Springer, 2013

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Describe the key technologies, architecture, strengths, limitations and applications of cloud computing and learn AWS networking, services, and management.	K-1K2	LO
CO2:	Examine the Cloud computing setup with it's vulnerabilities and applications using different architectures.	K3	IO
CO3:	Review the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.	K4-K5	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	-	-	-	-	-	-	-	-	-	-	M
CO2	M	S	S	M	S	-	S	S	M	M	-	M
CO3	M	M	S	M	S	-	L	-	-	-	-	S

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1C30 **Credits 2**

BIG DATA ANALYTICS – LAB

Course Objective

- To familiarize the tools required to manage and analyze big data like Hadoop, MapReduce, , Hive, Pig
- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability
- To enable students to have skills that will help them to solve complex

List of programs

1. Implement File System Shell Commands for HDFS in Hadoop Environment
2. Write a Mapreduce program using single reduce function for finding Maximum and Minimum Number
3. Write a Mapreduce program using multiple reduce function for Word Count in an given Text Document
4. Write a Mapreduce program for Matrix Multiplication
5. Write a Mapreduce program using multiple reduce function for Matrix Multiplication
6. Implement the following using Pig Latin
    a. Input and Output Operations
    b. Relational Operations
7. Implement the following using Pig Latin
    a. User Defined Functions
    b. Advanced Relational Operations
8. Implement the following using Hive commands
    a. Handling the Database
    b. Creating and Manipulating Table

9. Implement the following using Hbase commands
    a. Creation of Tables
    b. Table Manipulation
10. Create a Hive External Table stored by HBase in Hive

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand conceptually how Big Data is stored and implement it using different tools	K1-K2	LO
CO2:	Write program for data storage in HDFS and table manipulation using Big Data tools like HBASE, HIVE and PIG	K3	IO
CO3:	Critically analyse and examine existing Big Data datasets and implementations the solutions for it	K4- K5	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M		M	S	-	-	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-	-	-
CO3	S	S	S	S	S	S	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

Course-15UPCSC1C31 **Credits 2**

CLOUD COMPUTING – LAB

Course Objective

- To familiarize the tools required to manage and analyze cloud computing
- To teach the fundamental techniques and principles in achieving cloud computing with scalability and streaming capability
- To enable students to have skills that will help them to solve complex

List of programs

1. Find procedure to run the virtual machines can be utilized to run the virtual machine of different configuration. Check how many at particular time.
2. Find procedure to attach the virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine
3. Install a C Compiler in the virtual machine and execute a sample Program
4. Show the virtual machine migration based on the certain condition from one node to the other.
5. Find the procedure to install storage controller and interact with it.
6. Find the procedure to set up the one node Hadoop cluster
7. Write a program to use the API's of Hadooop to interact with it.
8. Find the procedure to implement the Identity Management (Open Stack)
9. Write a program for Web Feed using PHP and HTML
10. Find the procedure to implement Single Sign On (SSO)

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand how to use Cloud computing Solutions	K1-K2	LO
CO2:	Critically analyse existing applications and implementations, taking practicality, and usefulness metrics into consideration	K3	IO
CO3:	Write program for data storage and table manipulation using cloud environment	K4-K5	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S	S	S	M						
CO2	S	M	M	M	S	M						
CO3	S	S	S	S	S	S						

S- Strong; M-Medium; L-Low

COURSE- 18UPCSC1E01 **Credits: 3**

MICROPROCESSOR

Course Objective

- To understand the basic concepts of microprocessor and its different interface units

Unit-I

Introduction: Microprocessor system concepts - Microprocessor evolution - Areas of application. Microprocessor architecture and operation: Basic Microprocessor Architecture - Registers - Arithmetic and logic section - control section - Interface section - The 8085 Microprocessor - Architecture - timing and sequencing - state transition sequence - Memory and I/O synchronization - The wait state.

Unit-II

Programming the 8085: Instruction set - Programming Techniques - counter and time delay programs - stacks and subroutines - code conversion and BCD arithmetic programs. Memory Interfacings: Review of memory types and characteristics - compatibility between memory and microprocessor unit system bus - Address space - Partitioning of the Address space - Dynamic RAM Interfacing.

Unit-III

D/A and A/D conversion: variable - register network binary ladder-D/A converter-D/A accuracy and resolution A/D converter (simultaneous Conversion)-A/D conversion (counter method)-continuous A/D conversion-A/D techniques-Dual slope A/D Conversion-A/D accuracy and resolution. Interfacing Peripherals: Review of data transfer techniques - I/O ports - programmable I/O ports - the 8155h-8255a programmable peripheral interface - 8085 interrupt structure - and 8259a programmable interrupt controller - 8254 programmable interval timer - DMA controller. Serial mode of data transfer - 8251a USART - standard interfaces - interfacing keyboard - interfacing displays - 8279 programmable keyboard display interfaces.

Unit-IV

The 8086 Processor – Software aspects Evolution of Microprocessors – 8086 architecture – Addressing modes. Instruction set and assembler directives – Assembly language programming – Interrupts and interrupt service routines.

Unit-V

The Pentium and Pentium Pro Microprocessors : Introduction – Introduction to the Pentium Microprocessor – Special Pentium Registers – Pentium Memory Management – New Pentium Instructions – Introduction to the Pentium Pro Microprocessor – Special Pentium Pro Features.

Text Books

1. Gaonkar - "Microprocessor architecture - programming and applications" - Wiley Eastern Ltd –1993. (Chapter 3-5 - 6-10 - 13-15 - 17)

2. Barry B.Brey - "The Intel Microprocessors - 8086/8088 - 80186/80188. 80286 -80386 - 80486 - Pentium - Pentium Processor - Pentium II - Pentium III - Pentium IV - Architecture - Programming & Interfacing" – 7th Edition, PHI, 2008 (Chapters 2 - 3 - 8 - 17)

Reference Books

1. Kenneth L short, "Microprocessor and Programming Logic", PHI, 1988.

2. Ajith pal, "Microprocessors - Principles and Applications", Tata McGraw Hill, 1990.

3. A.K. Ray & K.M. Bhurcandi, "Advanced Microprocessors and peripheralsArchitectures - Programming and Interfacing", Tata McGraw Hill, 2002 reprint.

4. Yu-Cheng, Glenn A. Gibson, "Microcomputer systems: The 8086/8088 Family architecture - Programming and Design", PHI 2003.

5. Peter Abel, "IBM PC Assembly Language and Programming", Prentice Hall of India Pvt - Ltd.

6. Barry B. Brey& C.R. Sarma, "The Intel Microprocessors – Architecture - Programming - and Interfacing", Pearson Education Pte. Ltd, 2005.

7. U.S. Shah, "Microprocessor and Microcontrollers", Tech-Max Publications, 2005

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1:	Articulate the basic concepts of Microprocessor systems	K4,K5, K6	HO
CO2:	Appraise the design and functioning of a machines central processing unit (CPU).	K1, K2	LO
CO3:	Understanding the concepts of Pentium and Pentium Pro Microprocessors	K3	IO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6-Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	M	M	M	M	-	-	-	-	-	-	-
CO2	M	M	S	-	-	-	S	-	-	-	-	-
CO3	S	S	S	S	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

COURSE-18UPCSC1E02 **Credits: 3**

PARALLEL PROCESSING

Course Objective:

- To understand basic study of parallel computers
- To understand networking properties.
- To know about the linear pipeline concepts.

UNIT -I PARALLEL COMPUTER MODELS

The State of Computing: Computer development milestones-Elements of modern computers-Evolution of computer architecture- System attributes to performance. Multiprocessors and Multicomputers: shared-memory and multiprocessors-Distributed-memory multicomputers- A Taxonomy of MIMD computers. Multivector and SIMD Computers: Vector super computers-SIMD super computers. PRAM and VLSI Models: Parallel Random-access machines-VLSI complexity model. Architectural Development Tracks: Multiple-processor tracks-Multi-vector and SIMD tracks.

UNIT-II PROGRAM AND NETWORK PROPERTIES

Conditions of Parallelism: Data and resource dependences-Hardware and software parallelism-The role of compilers. Program Partitioning and Scheduling: Grain sizes and latency-Grain packing and scheduling-Static multiprocessor scheduling- Program Flow Mechanisms: Control flow versus data flow-Demand-driven mechanisms- System Interconnect Architectures: Network properties and routing- Static connection networks- Dynamic connection networks.

UNIT-III PRINCIPLES OF SCALABLE PERFORMANCE

Performance Metrics and Measures: Parallelism profile in programs-Harmonic mean performance-Efficiency, utilization, and quality-Standard performance measures. Parallel Processing Applications: Massive parallelism for grand challenges-Application models of parallel computers. Speedup Performance Laws: Amdahl's law for a fixed workload. Scalability Analysis

and Approaches: Scalability metrics and goals-Evolution of scalable computers.

UNIT–IV PROCESSORS AND MEMORY HIERARCHY

Advanced Processor Technology: Design space of processors – Instruction set architectures. Superscalar and Vector Processors: Superscalar processor. Memory Hierarchy Technology: Hierarchical memory technology. Virtual Memory Technology: Virtual memory models- TLB, paging and segmentation.

UNIT–V PIPELINING

Linear Pipeline Processors: Asynchronous and synchronous models-Clocking and timing control-speedup, efficiency and throughput. Nonlinear Pipeline Processors: Reservation and latency analysis-Collision-Free scheduling-Pipeline schedule optimization. Instruction Pipeline Design: Instruction execution phases-Mechanisms for instruction pipelining-Dynamic instruction scheduling-Branch handling techniques. Arithmetic Pipeline Design: Computer arithmetic principles- Static arithmetic pipelines-Multifunctional arithmetic pipelines.

Text Book

1. Kai Hwang, “Advanced Computer Architecture”, TMGH, India, 2008.

Reference Book

1. BehroozParhami, “Introduction to Parallel Processing – Algorithms and Architectures” Plenum series, 2002.

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1:	Recognize basic concepts of parallel pipeline systems.	K1,K2	LO
CO2:	Categorize the concepts pipeline architecture.	K3	IO
CO3:	Exemplify the techniques of linear pipeline	K4,K5, K6	HO

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	S	S	S	-	-	-	-	-	-	-
CO2	M	S	S	-	-	-	-	-	-	-	-	-
CO3	L	M	M	M	-	-	-	-	-	-	M	-

COURSE - 18UPCSC1E03 **Credits: 3**

GRAPH THEORY

Course Objective:

- This course provides opportunities to students to develop and demonstrate basic communication skills in technical, professional and social contexts effectively.

Unit–I: Introduction-Discovery of graphs, Definitions, Subgraphs, Isomorphic graphs, Matrix representations of graphs, Degree of a vertex, Directed walks, paths and cycles, Connectivity in digraphs, Eulerian and Hamilton digraphs, Eulerian digraphs, Hamilton digraphs, Special graphs, Complements, Larger graphs from smaller graphs, Union, Sum, Cartesian Product, Composition, Graphic sequences, Graph theoretic model of the LAN problem, Havel-Hakimi criterion, Realization of a graphic sequence.

Unit – II: Connected graphs and shortest paths –Walks, trails, paths, cycles, Connected graphs, Distance, Cut-vertices and cut-edges, Blocks, Connectivity, Weighted graphs and shortest paths, Weighted graphs, Dijkstra's shortest path algorithm, Floyd-Warshall shortest path algorithm.

Unit III: Trees-Definitions and characterizations, Number of trees, Cayley's formula, Kircho-matrix-tree theorem, Minimum spanning trees, Kruskal's algorithm, Prim's algorithm, Special classes of graphs, Bipartite Graphs, Line Graphs, Chordal Graphs, Eulerian Graphs, Fleury's algorithm, Chinese Postman problem, Hamilton Graphs, Introduction, Necessary conditions and sufficient conditions.

Unit IV: Independent sets coverings and matchings –Introduction, Independent sets and coverings: basic equations, Matchings in bipartite graphs, Hall's Theorem, K¨onig's Theorem, Perfect matchings in graphs, Greedy and approximation algorithms.

Unit – V: Vertex Colorings-Basic definitions, Cliques and chromatic number, Mycielski's theorem, Greedy coloring algorithm, Coloring of chordal graphs, Brooks theorem, Edge Colorings, Introduction and Basics, Gupta-Vizing

theorem, Class-1 and Class-2 graphs, Edge-coloring of bipartite graphs, Class-2 graphs, Hajos union and Class-2 graphs, A scheduling problem and equitable edge-coloring.

TEXTBOOKS:

1. J. A. Bondy and U. S. R. Murty. Graph Theory, volume 244 of Graduate Texts in Mathematics. Springer, 1st edition, 2008.
2. J. A. Bondy and U. S. R. Murty. Graph Theory with Applications https://www.iro.umontreal.ca/~hahn/IFT3545/GTWA.pdf

REFERENCES:

1. Lecture Videos: http://nptel.ac.in/courses/111106050/13

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Categorizebasic concept of Graph Theory	K3	IO
CO2:	Recognize graph, tree, Euler graph, cut set and Algorithms	K1,K2	LO
CO3:	Relate the real time problems using concepts of graph theory	K4, K5, K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	-	M	-	-	-	-	-
CO2	S	M	M	M	M	-	M	-	-	-	-	-
CO3	L	M	S	M	S	-	M	-	-	-	-	-

S- Strong; M-Medium; L-Low

COURSE - 18UPCSC1E04 **Credits: 3**

COMPUTER GRAPHICS

Course Objectives:

- To understand basic display system, display mechanisms and algorithms
- To understand necessary Approaches and Techniques to the graphics system in order to provide effective view to the users.
- To know about the colour models and animation concepts.

Unit I

Overview: Video display devices – Raster and Random scan system – Input devices Output primitives: Points and Lines – Line drawing algorithms – Loading the frame buffer – Line function.

Unit II

Circle generating and Ellipse generating algorithm Pixel addressing and object geometry – Filled area primitives – Fill area function – Cell array – Character generation.Attributes of output primitives: Line attributes – Color and Grayscale levels – Area fill and Character attributes – Antialiasing. 2D Geometric transformations: Basic transformations – Composite – Reflection and Shear – Transformations between Coordinate systems.

Unit III

Affine transformations – Functions – Raster methods 2D Viewing: Viewing Pipeline – Coordinate reference frame – Window to Viewport – Viewing functions – Clipping operations – Line, Polygon, Text and Exterior clipping – GUI and Interactive input methods: User dialogue – Input of Graphical data – Input functions – Initial value – Picture construction – Virtual reality environments..

Unit IV

3D Concepts: Display methods Object Representations – Polygon surface – Curved lines and surface – Quadratic – Spline representation. 3D Geometric and Modeling transformations: Translation – Rotation – Scaling – Reflections – Shears – Composite transformations – functions. 3D Viewing: Pipeline – Coordinates – Projections – Clipping – Functions..

Unit V

Visible surface detection methods: Classification – Back face – Depth buffer – A buffer – Depth sorting – BSP – Area subdivision – Octree – Ray casting Color models and Applications: Properties of light – Standard primaries and Chromaticity diagram – RGB, YIQ, CMY, and HSV color models. Computer

animations: Design – functions – Raster animations – Key frame systems – Motion specifications.

Text Book

1. Donald Hearn M. Pauline Baker, "Computer Graphics", Second Edition, Pearson Education Twelveth Impression, 2011.
(Chapters: 2.1- 2.3, 2.5, 3.1 - 3.6, 3.10 - 3.14, 4.1, 4.3 - 4.5, 4.8, 5.1, 5.3 - 5.8, 6.1 - 6.8, 6.10 – 6.11, 8.1 – 8.6, 9.1, 10.1 – 10.3, 10.6, 11.1 – 11.6, 12.1 – 12.3, 12.5, 12.7, 13.1 – 13.10, 15.1 – 15.2, 15.4 – 15.7, 16.1 – 16.3, 16.5 – 16.6)

Reference Books

1. F.S Hill, JR, "Computer Graphics using Open GL", Second Edition, PHI, 2005
2. R.G.S Asthana, N. K. Sinha, "Computer Graphics for Scientists and Engineers" Second Edition, New Age international Publishers, 2003

Course Outcomes:
On the successful completion of the course, students will be able to:

CO1:	Distinguish the fundamentals of Graphics system, display devices and techniques and pixel transformations .	K1,K2	LO
CO2:	Categorize the usage of graphical operations of drawing algorithms.	K3	IO
CO3:	Illustrate various surface detection methods to simulate the user visibility in different applications	K4,K5, K6	HO

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	L	S	M	-	-	-	-	-	-	-
CO2	S	S	S	-	-	-	M	-	-	-	-	-
CO3	L	M	S	M	M	-	M	-	-	-	-	-

ELECTIVE – II LIST

COURSE - 18UPCSC1E05 **Credits: 3**

OBJECT OREIENTED ANALYSIS AND DESIGN

Course Objective

- To understand the object oriented methodologies and workflows.
- To describe the object oriented software development process and apply the concepts of abstraction, encapsulation, inheritance and polymorphism.

Unit-I

The Object: The evolution of the Object model-Elements of the Object model-Applying object model. Classes and Objects: The nature of Object-Relationships among objects.

Unit-II

Classes and Objects: The nature of the class-Relationship among classes-The Interplay of Classes and Objects-On building quality classes and objects. Classification: The importance of proper classification-Identifying proper classes and objects-Key abstraction mechanism.

Unit-III

Introduction to UML-Development Process-The Class Diagram: Essential and Advanced Concepts-Sequence Diagrams-Object Diagrams-Package Diagrams.

Unit-IV

Deployment Diagrams-Use Cases-State Machine Diagram-Activity Diagram Communication Diagram-Component Diagram-Collaboration-Interaction Diagram-Timing Diagram.

Unit-V

Process-Pragmatics- Applications: System Architecture: Based Navigation-Control System: Traffic Management-Data Acquisition: Weather Monitoring.

Text Books

1. Grady Booch, RobertA .Maksimchuk, Michael W.Engle, Bobbi J.Young, Ph.D, Jim Conallen, KelliA. Houston ,“Object Oriented Analysis and Design with Applications”, Third Edition-sixth impression-2012 (Chapters- 1, 2,3,4,5,6,7,8,9,11).

Reference Books

1. Bernd Bruegge, Allen H.Dutoit "Object Oriented Software Engineering using UML,Patterns,and Java"- 2010.
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design Pattern Elements of Reusable Object Oriented Software"- 2009.
3. Grady Booch, Robert A.Maksimchuk, Michael W.Engle, Bobbi J.Young,Ph.D, Jim Conallen, Kelli A.Houston ,"Object Oriented Analysis and Design with Applications",Third Edition- 2007.

Course Outcome:

On the successful completion of the course, students will be able to

CO1:	Role-Play the evolution of the Object model	K1,K2	LO
CO2:	Analyse the concept of Classes and Objects, Key abstraction and UML	K4,K5, K6	HO
CO3:	Illustrate the Use Cases and applications	K3	IO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	M	S	-	-	-	-	-	-	-	-
CO2	L	M	S	M	-		-	-	-	-	-	-
CO3	S	M	S	-	-	-	-	-	M	-	S	-

S- Strong; M-Medium; L-Low

COURSE- 18UPCSC1E06 **Credits: 3**

ROBOTICS

Course Objectives

- To understand Robotics Theories, Drivers, Sensors and Operating Systems.
- To understand design approaches and techniques to build Robot for various applications.
- To know about the Python language in order to simulate activities of Robots.

UNIT I

Introduction: Brief Historical Review and Main Definitions-Definition of Levels or Kinds of Robots -Manipulators -Structure of Automatic Industrial Systems -Nonindustrial Representatives of the Robot Family -Relationship between the Level of Robot "Intelligence" and the Product .**Concepts and Layouts**: Processing Layout ,How Does One Find the Concept of an Automatic Manufacturing Process-How to Determine the Productivity of a Manufacturing Process - The Kinematic Layout - Rapid Prototyping.
Chapters-1.1-1.6,2.1-2.5

UNIT II

Dynamic Analysis of Drives: Mechanically Driven Bodies -Electromagnetic Drive -Electric Drives -Hydraulic Drive -Pneumodrive -Brakes -Drive with a Variable Moment of Inertia. **Feedback Sensors**: Linear and Angular Displacement Sensors -Speed and Flow-Rate Sensors-Force Sensors - Temperature Sensors -Item Presence Sensors. **Transporting Devices** General Considerations - Linear Transportation Rotational Transportation - Vibrational Transportation.
Chapters-3.1-3.7,5.1-5.5,6.1-6.4

UNIT III

Getting Started with Robot Operating System-Introduction to ROS - **Simulating a Differential Drive Robot Using ROS**- Getting started with the Gazebo simulator -The Gazebo's graphical user interface-Working with a TurtleBot 2 simulation - Creating a simulation of Chefbot- Depth image to laser scan conversion -URDF tags and plugins for Gazebo simulation - Visualizing the robot sensor data- Getting started with Simultaneous Localization and Mapping - Creating a map using SLAM - Getting started

with Adaptive Monte Carlo Localization - Implementing AMCL in the Gazebo environment - Autonomous navigation of Chefbot in the hotel using Gazebo.
Chapters-1,4

UNIT IV

Designing ChefBot Hardware and Circuits- Specifications of the ChefBot's hardware - Block diagram of the robot -Motor and encoder -Motor driver - Selecting a motor driver/controller Embedded controller board -Ultrasonic sensors- Inertial measurement unit -Kinect/Orbbec Astra - Central processing unit - Speakers/mic -Power supply/battery.HowChefBot's hardware works'? **Interfacing Actuators and Sensors to the Robot Controller**-Interfacing DC geared motor to Tiva C LaunchPad -Differential wheeled robot - Installing Energia IDE - Motor interfacing code-Interfacing quadrature encoder with Tiva C Launchpad -Processing encoder data - Interfacing HC-SR04 to Tiva C LaunchPad - Working of HC-SR04 - Interfacing Code of Tiva C Launchpad - Interfacing Tiva C LaunchPad with Python -Quadrature encoder interfacing code- Working with Dynamixel actuators -Working with ultrasonic distance sensors - Working with the IR proximity sensor - Working with Inertial Measurement Units - Inertial navigation -Interfacing MPU 6050 with Tiva C LaunchPad 159 -Interfacing code of Energia.
Chapters-5,6

UNIT V

Building ChefBot Hardware and the Integration of Software-Building ChefBot hardware -Configuring ChefBot PC and setting ChefBot ROS packages - Interfacing ChefBot sensors to the Tiva-C LaunchPad -Embedded code for ChefBot-Writing a ROS Python driver for ChefBot - Understanding ChefBot ROS launch files - Working with ChefBot Python nodes and launch files -Working with SLAM on ROS to build a map of the room - Working with ROS localization and navigation-**Designing a GUI for a Robot Using Qt and Python**- Installing Qt on Ubuntu 16.04 LTS - Working with Python bindings of Qt –PyQt-PySide-Working with PyQt and PySide -Introducing Qt Designer - Qt signals and slots -Converting a UI file into Python code - Adding a slot definition to PyQt code - Operation of the Hello World GUI application - Working with ChefBot's control GUI - Installing and working with rqt in Ubuntu 16.04 LTS.
Chapters-8,9

TEXT BOOKS

1. Ben-Zion Sandier "ROBOTICS Designing the Mechanisms for Automated Machinery "Second Edition. Copyright © 1999 by Academic Press

2. Lentin Joseph "Learning Robotics using Python", Second Edition, Design, simulate, program, and prototype an autonomous mobile robot using ROS, OpenCV, PCL, and Python"Published by Packt Publishing Ltd, ISBN 978-1-78862-331-5.

REFERENCE BOOKS

1. Deb. S.R., "Robotics Technology and flexible Automation", John Wiley, USA
1992.

2. Klafter R.D., Chimielewski T.A., Negin M., "Robotic Engineering – An integrated

3. approach", Prentice Hall of India, New Delhi, 1994.

4. McKerrow P.J. "Introduction to Robotics", Addison Wesley, USA, 1991.

5. Issac Asimov "Robot", Ballantine Books, New York, 1986.

6. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and
Intelligence", McGraw-Hill Book Co., 1987

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1:	Discriminate the fundamentals Understand the fundamentals of Robotics, Drivers, Sensors and Operating systems	K1, K2	LO
CO2:	Classify the different techniques to build Robot with various Operating systems	K3	IO
CO3:	Exemplify various sensors in Controller for Robot design and Authentication schemes to simulate different applications	K4, K5, K6	HO

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	S	L	M	-	L	-	-	-	-	-
CO2	M	M	S	M	M	-	S	-	-	-	-	-
CO3	L	S	M	M	M	-	S	-	L	-	M	-

COURSE - 18UPCSC1E07 **Credits: 3**

WEB SERVICES

Course Objectives

- To learn how to use Cloud Services.
- Design and implement Web Services that accommodates specified functional and non-functional requirements and constraints. Design web-based applications that consume such Web Services.
- Analyze and model requirements and constraints for the purpose of designing and implementing systems based on collaborating Web Services, with an emphasis on extensible and reusable architecture.

Unit – I

Web Services and Service-Oriented Architectures: Service-Oriented Architecture Overview: Services – Connections – The Architecture in SOA. **Web Services Explained:** History of web services specifications – web services specifications. **Service-Oriented Architecture Explained:** Relationship of web services and SOA – Identification and design of services. **Cloud Computing:** Blurring of internal and external services – Architecture with cloud computing – The cloud – Types of Cloud – Categories of Cloud provides.

Unit – II

Technical Forces Driving the Adoption of Web Services: Force Field Analysis Overview - Adopting Standard Data Element Definitions - Adopting a Standard Communications Protocol - Adopting Web Services. **Technical Forces Driving the Adoption of SOA:**Adopting Standard, Enterprise-Wide Software - Adopting an Object Request Broker - Adopting an Enterprise Data Warehouse - Adopting an Enterprise Service Bus - Adopting a Service-Oriented Architecture. **Technical Forces Driving the Adoption of Cloud Computing:**Adopting Software as a Service (SaaS) - Adopting Platform as a Service (PaaS) - Adopting Service-Oriented Architecture with Cloud Computing.

Unit - III

Getting Started with Web Services: The Impact of Web Services - Use of Web Services - Start by Experimenting with Web Services - Adapt Existing Systems to Use Web Services. Getting Started with Service-Oriented Architectures**:** Establish a Service-Oriented Architecture - Services and Service-Oriented Architectures - SOA Governance. Getting Started with Cloud Computing**:** Expand Your Internal SOA to Include External Services -

Data Center Considerations - Examples of Technical Issues Related to Availability - Cloud Brokers.

Unit – IV

Amazon Web Services Philosophy and Design: Understanding the Amazon Business Philosophy - The AWS Infrastructure - The AWS Ecosystem - AWS versus Other Cloud Providers. Introducing the AWS API - Introducing the AWS Management Console - Setting Up AWS Storage - Stretching Out with Elastic Compute Cloud. **AWS Networking:** Brushing Up on Networking Basics - AWS Network IP Addressing - AWS IP Address Mapping - AWS Direct Connect - High-Performance AWS Networking - AWS Elastic IP Addresses - AWS Instance Metadata - Instance IP Address Communication.

Unit – V

AWS Security: The Deperimeterization of Security - AWS Security Groups - Using Security Groups to Partition Applications - AWS Virtual Private Cloud (VPC). **Additional Core AWS Services:** Understanding the Other AWS Services - CloudFront- Relational Database Service (RDS) - AWS Platform Services - AWS Management Services.

Text Books

1. Douglas K. Barry, David Dick, "Web Services, Service-Oriented Architectures, and Cloud Computing: The Savvy Manager's Guide", Morgan Kaufmann; 2 edition, 2013.
(Unit 1: Chapter 3 and 4; Unit 2: Chapter 5, 6, and 7; Unit 3: Chapter 11, 12, and 13)
2. Bernard Golden, "Amazon Web Services For Dummies", John Wiley & Sons, Inc, 2013. (Unit 4: Chapter 1 to 6; Unit 5: 7 to 10)

Reference Books

1. B.V. Kumar and S.V. Subrahmanya, "Web Services An Introduction", Tata McGraw-Hill Education, Third Edition, 2012.
2. M. Papazoglou, "Web Services: Principles and Technology", Pearson Prentice Hall, 2008.
3. Letha Hughes Etzkorn, "Introduction to Middleware: Web Services, Object Components, and Cloud Computing", Chapman and Hall/CRC; 1 edition, 2017.
4. Michael J. Kavis, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)",Wiley; 1 edition, 2014.

Course outcomes:

On the successful completion of the course, students will be able to:

CO1:	Examine Cloud computing setup with it's vulnerabilities and applications using different architectures.	K1, K2	LO
CO2:	Associate scalable *web services* from the *cloud*	K4, K5,K6	HO
CO3:	Construe a AWS networking, services, and management.	K3	IO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	M	M	M	S	-	-	-	L	-	-	-
CO2	L	M	L	L	M	-	-	-	L	-	-	-
CO3	S	S	S	L	S	-	-	L	M	-	-	-

S- Strong; M-Medium; L-Low

COURSE - 18UPCSC1E08 **Credits: 3**

THEORY OF COMPUTATION

Course Objective:

- To the mathematical foundations of computation including automata theory
- To learn the theory of formal languages and grammars
- To learn the notions of algorithm - decidability - complexity - and computability
- To enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

Unit - I

Introduction to formal proof – Additional forms of proof – Inductive proofs – FiniteAutomata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic FiniteAutomata (NFA) – Finite Automata with Epsilon transitions.

Unit - II

Regular Expression – FA and Regular Expressions – Proving languages not to beregular – Closure properties of regular languages – Equivalence and minimization ofAutomata.

Unit - III

Context-Free Grammar (CFG) – Parse Trees – Ambiguity in grammars and languages – Definition of the Pushdown automata – Languages of a Pushdown Automata –Equivalence of Pushdown automata and CFG– Deterministic Pushdown Automata.

Unit - IV

Normal forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM. A language that is not Recursively Enumerable (RE).

Unit - V

An undecidable problem RE – Undecidable problems about Turing Machine – Post's Correspondence Problem – The classes P and NP.

Text Books

1. Peter Linz - "An Introduction to Formal Languages and Automata" -Fifth Edition -Narosa - 2012
2. J.E. Hopcroft - R. Motwani and J.D. Ullman - "Introduction to Automata Theory - Languages and Computations" - second Edition - Pearson Education - 2007.

Reference Books

1. H.R. Lewis and C.H. Papadimitriou - "Elements of the theory of Computation" - Second Edition - Pearson Education - 2003.
2. Thomas A. Sudkamp -" An Introduction to the Theory of Computer Science -Languages and Machines" - Third Edition - Pearson Education - 2007.
3. Raymond Greenlaw an H.James Hoover -" Fundamentals of Theory of Computation - Principles and Practice" - Morgan Kaufmann Publishers - 1998.
4. MichealSipser - "Introduction of the Theory and Computation" - Thomson Brokecole - 1997.
5. J. Martin - "Introduction to Languages and the Theory of computation -" Third Edition - Tata McGraw Hill - 2007.

Course outcomes:

On the successful completion of the course, students will be able to:

CO1:	Observe the basic concepts of NFA and DFA.	K1, K2
CO2:	Interpretthe theory of formal languages and grammars	K3
CO3:	Consociatethe mathematical proofs for computation and algorithms.	K4, K5,K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	S	S	S	-	-	-	-	-	-	-
CO2	M	M	S	S	M	-	-	-	-	-	-	-
CO3	L	S	S	S	S	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

ELECTIVE – III LIST

COURSE-18UPCSC1E09 **Credits: 3**

STATISTICAL COMPUTING

Course Objective:

- To understand the applications of various correlation methods
- To study and model the sampling concepts
- To acquire knowledge on Hypotheses test

Unit-I:

Correlation - Definition of Correlation- Scatter Diagram- Kari Pearson's Coefficient of Linear Correlation- Coefficient of Correlation and Probable Error of r- Coefficient of Determination - Merits and Limitations of Coefficient of Correlation- Spearman's Rank Correlation(7.1-7.9.4).

Unit-II:

Regression Analysis - Regression and Correlation(Intro)- Difference between Correlation and Regression Analysis- Linear Regression Equations -Least Square Method- Regression Lines- Properties of Regression Coefficients- Standard Error of Estimate.(8.1-8.8)

Unit-III:

Probability Distribution and mathematical Expectation- Random Variable- Defined - Probability Distribution a Random Variable- Expectation of Random Variable- Properties of Expected Value and Variance(12.2-12.4).

Unit-IV:

Sampling and Sampling Distributions - Data Collection- Sampling and Non-Sampling Errors – Principles of Sampling-- Merits and Limitations of Sampling- Methods of Sampling- Parameter and Statistic- Sampling Distribution of a Statistic- Examples of Sampling Distributions- Standard Normal, Student's t, Chi-Square (x2) and Snedecor's F- Distributions(14.1-14.16).

Unit-V:

Statistical Inference- Estimation and Testing of Hypothesis - Statistical Inference- Estimation- Point and interval- Confidence interval using normal, t and x2Distributions- Testing of Hypothesis- Significance of a mean - Using t Distribution(15.1-15.10.2).

Textbook:

1. K.L. Sehgal, "Quantitative Techniques and Statistics", First Edition, Himalaya Publishing House, 2011.

References:

1. N. P. Bali, P. N. Gupta, C. P. Gandhi, "A Textbook of Quantitative Techniques", First Edition, Laxmi Publications, 2008.
2. U. K. Srivastava, G. V. Shenoy, S. C. Sharma, "Quantitative Techniques for Managerial Decisions", Second Edition, New Age International Publishers, 2005.
3. David Makinson, "Sets, Logic and Maths for Computing", Springer, 2011.
4. Christopher Chatfield,"Statistics for Technology- A Course in Applied Statistics, Third Edition", CRC Press, 2015.

Course outcomes:

On the successful completion of the course, students will be able to:

CO1:	Apprehend the basics of Correlation, Regression	K1, K2	LO
CO2:	Articulate the properties of Regression Coefficients and apply Sampling Distribution	K4, K5,K6	HO
CO3:	Interpretthe concept of testing of Hypothesis.	K3	IO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	M	L	M	M	-	-	-	L	-	-	-
CO2	L	M	L	L	M	-	-	-	M	-	-	-
CO3	L	S	S	S	S	-	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

COURSE- 18UPCSC1E10 **Credits: 3**

OPTIMIZATION TECHNIQUE

Course Objective:

- To understand the concept of optimization
- To develop mathematical model of real life cases
- To study Optimization algorithms

Unit – I

Linear Programming Problem (LPP): Formulations and graphical solution of (2 variables) canonical and standard terms of linear programming problem. Simplex method - Two phase simplex method

Unit – II

Duality in LPP- dual problem to primal- primal to dual problem-duality simplex method-Revised simplex method-revised simplex algorithm-revised simplex method versus simplex method

Unit – III

Transportation Model: North West corner Method - Least cost method - and vogel's approximation method. Determining Net evaluation-Degeneracy in TP-Assignment Model : Hungarian assignment model – Travelling sales man problem.

Unit – IV

Replacement Problem: Replacement policy for equipment that deteriorate gradually - Replacement of item that fail suddenly-Individual and group replacement - Problems in mortality and staffing.

Unit – V

Project Scheduling PERT/CPM Networks – Fulkerson's Rule – Measure Of Activity – PERT Computation – CPM Computation – Resource Scheduling.

Text Books

1. KantiSwarup - P.K. Gupta &Manmohan – Operation Research 1996.
2. S.Kalavathy: Operations Research – Second Edition – Vikas Publishing House Pvt.Ltd.
3. S.GodfreyWinster - S. Aruna Devi - R.Sujatha - "Compiler Design" - Yesdee Publishing.

Reference Books

1. D.Shanthi - N.UmaMaheswari - S.Jeyanthi - "Theory of Computation" - Yesdee Publishing.
2. John W.Chinneck - "Feasibility and Infeasibility in Optimization-Algorithms and ComputatonalMethods " - Springer - 2015.

Course outcomes:

On the successful completion of the course, students will be able to:

CO1:	Describe the Feasibility study for solving an optimization problem	K1, K2	LO
CO2:	Extract and measure the performance of an algorithm - Discovery - study and solve optimization problems.	K3	IO
CO3:	Devise to understand optimization techniques using algorithms to develop and promote innovative solutions for various applications.	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	S	L	S	-	-	-	L	-	-	-
CO2	S	M	M	L	M	-	-	-	L	-	-	-
CO3	L	S	L	L	1	-	-	L	M	-	-	-

S- Strong; M-Medium; L-Low

COURSE- 18UPCSC1E11 **Credits: 3**

WIRELESS NETWORKS

Course Objective:

- To Study about Wireless Networks - Protocol Stack and Standards.
- To Study about Fundamentals of 3G Services - Its Protocols and Applications.
- To Study about Evolution of 4G Networks - its Architecture and Applications.

Unit - I

Wireless LAN - Introduction-WLAN Technologies: Infrared - UHF Narrowband - Spread Spectrum -IEEE802.11: System Architecture - Protocol Architecture - Physical Layer - MAC Layer - 802.11b - 802.11a – Hiper LAN: WATM - BRAN - HiperLAN2 – Bluetooth: Architecture - Radio Layer - Baseband Layer - Link Manager Protocol - Security – IEEE802.16-WIMAX: Physical Layer - MAC - Spectrum Allocation For WIMAX

Unit - II

Mobile Network Layer - Introduction – Mobile IP: IP Packet Delivery - Agent Discovery - Tunneling And Encapsulation - IPV6-Network Layer In The Internet- Mobile IP Session Initiation Protocol – Mobile Ad-Hoc Network: Routing - Destination Sequence Distance Vector - Dynamic Source Routing.

Unit - III

Mobile Transport Layer - TCP Enhancements For Wireless Protocols – Traditional TCP: Congestion Control - Fast Retransmit/Fast Recovery - Implications Of Mobility – Classical TCP Improvements: Indirect TCP - Snooping TCP - Mobile TCP - Time Out Freezing - Selective Retransmission - Transaction Oriented TCP – TCP Over 3G Wireless Networks.

Unit - IV

Wireless Wide Area Network - Overview Of UTMS Terrestrial Radio Access Network-UMTS Core Network Architecture: 3G-MSC - 3G-SGSN - 3G-GGSN - SMS-GMSC/SMS-IWMSC - Firewall - DNS/DHCP-High Speed Downlink Packet Access (HSDPA)- LTE Network Architecture And Protocol.

Unit - V

4G Networks - Introduction – 4G Vision – 4G Features And Challenges – Applications Of 4G – 4G Technologies: Multicarrier Modulation - Smart

Antenna Techniques - OFDM-MIMO Systems - Adaptive Modulation And Coding With Time Slot Scheduler - Cognitive Radio.

Text Books

1. Jochen Schiller - "Mobile Communications" - Second Edition - Pearson Education 2012.(Unit I -II -III)

2. Vijay Garg - "Wireless Communications And Networking" - First Edition - Elsevier 2014.(Unit IV -V)

Reference Books

1. Erik Dahlman - Stefan Parkvall - Johan SkoldAndPerBeming - "3G Evolution HSPA And LTE For Mobile Broadband" - Second Edition - Academic Press - 2008.

2. Anurag Kumar -D.Manjunath - Joy Kuri - "Wireless Networking" - First Edition - Elsevier 2011.

3. Simon Haykin- Michael Moher - David Koilpillai - "Modern Wireless Communications" - First Edition - Pearson Education 2013.

4. David G. Messerschmitt - "Understanding Networked Applications" - Elsevier - 2010.

Course outcomes:

On the successful completion of the course, students will be able to:

CO1:	Collaborate the concepts of Wireless LAN and the technologies of Mobile Network Layer and Mobile Transport Layer.	K1, K2	LO
CO2:	Apply the functionality of wireless technology for real world solutions	K3	IO
CO3:	Review the functionality of wireless networks and design the networks	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	S	S	S	S	-	-	-	S	-	-	-
CO2	L	M	M	S	M	-	-	-	M	-	-	-
CO3	L	M	L	M	L	-	-	S	L	-	-	-

S- Strong; M-Medium; L-Low

COURSE-18UPCSC1E12 **Credits: 3**

NUMERICAL METHODS

Course Objective

- To explain the fundamental concepts of Empirical Laws and Curve Fitting.
- To develop solutions for linear algebraic equations via different methods.

Unit I

Empirical Laws and curve fitting: Introduction – Laws reducible the linear law – method of group averages – Laws containing three constants – principle of least squares – Fitting of a straight line- fitting of a parabola – Fitting an exponential curve –methods of moments.

Unit – II

Transcendental Equation and Algebraic Equations: Introduction – Bisection Method, Newton – Rapson Method – Method of false position – Horner's Method.

Unit – III

Solutions of Linear Algebraic Equations: Direct Methods: GuassEliminationMethod – Gauss Jordan Method – Crout's Method. Iterative Methods: Gauss Jacobi's Method – Gauss Seidal Method – Relaxation Mathod.

Unit – IV

Finite Differences: Newton's Forward Interpolation Formula – Newton's Backward Interpolation Formula. Central Differences – Gauss's Forward Formula – Guass Backward Formula Sirling's Formula – Bessel's Formula.

Unit – V

Interpolation with unequal Intervals: Divided Differences – Inverse Interpolation – Numerical Differentiation – Numerical Integration.

Text Books

1. Singaravelu, Numerical Methods, MeenakshiPublicationns, Chennai, 1999.

Reference Books

1. S.S. Sastry, "Intriductory Methods of Numerical Analysis", PHI, New Delhi, 1982.
2. M.K.Jain, S.R.K.Iyengar and R. K. Jain, "Numerical Methods for Science and Engineering Computation", Wiley Eastern Limited – 2nd Edition, 1995.

Course outcomes:

On the successful completion of the course, students will be able to:

CO1:	Invent the fundamental concepts of Empirical Laws and Curve Fitting	K1, K2	LO
CO2:	Defend the Solutions of Linear Algebraic Equations	K3	IO
CO3:	Articulate the Interpolation with unequal Intervals	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	M	S	S	S	-	-	-	M	-	-	-
CO2	S	M	L	S	M	-	-	-	S	-	-	-
CO3	L	S	L	M	L	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

ELECTIVE – IV LIST

COURSE-18UPCSC1E13 **Credits: 3**

INTERNET OF THINGS

Course Objective

- To assess the vision and introduction of IoT..
- To Implement Data and Knowledge Management and use of Devices in IoT Technology
- To classify Real World IoT Design Constraints, Security in IoT.

UNIT I
IOT ECOSYSTEM CONCEPTS AND ARCHITECTURES:

Internet of Things: An Overview: Introduction - Internet of Things Definition Evolution - IOT Architectures - Resource Management - IOT Data Management and Analytics - Communication Protocols - Internet of Things Applications – Security - Identity Management and Authentication – Privacy - Standardization and Regulatory Limitations Open Source Semantic Web Infrastructure for Managing IOT Resources in the Cloud: Introduction - Background/Related Work – Open IOT Architecture for IOT/Cloud Convergence - Scheduling Process and IOT Services Lifecycle - Scheduling and Resource Management - Validating Applications and Use Cases - Future Research Directions

UNIT II
IOT ENABLERS AND SOLUTIONS

Programming Frameworks for Internet of Things: Introduction – Background - Survey of IOT Programming Frameworks - Future Research Directions Virtualization on Embedded Boards as Enabling Technology for the Cloud of Things: Introduction – Background - Virtualization and Real-Time - Experimental Results - Future Research Directions

UNIT III
IoT DATA AND KNOWLEDGE MANAGEMENT

Stream Processing in IoT: Foundations, State-of-the-Art, and Future Directions: Introduction - The Foundations of Stream Processing in IoT - Continuous Logic Processing System - Challenges and Future Directions : A Framework for Distributed Data Analysis for IoT: Introduction - Preliminaries - Anomaly Detection - Problem Statement and Definitions - Distributed Anomaly Detection - Efficient Incremental Local Modeling

UNIT IV

IoT RELIABILITY, SECURITY, AND PRIVACY

Security and Privacy in the Internet of Things: Concepts - IoT Security Overview - Security Frameworks for IoT - Privacy in IoTNetworks Internet of Things—Robustness and Reliability: Introduction - IoT Characteristics and Reliability Issues - Addressing Reliability

UNIT V

IoT APPLICATIONS

Applied Internet of Things: Introduction – Scenario - Architecture Overview - Sensors - The Gateway – Data Transmission Internet of vehicles and Application: Basic of IoV - Characteristics and Challenges - Enabling Technologies – Applications Cloud-Based Smart-Facilities Management: Introduction - Background and Related Work - A Cloud-Based Architecture for Smart-Facility Management - Middleware Services - Resource Management Techniques for Wireless Sensor Networks - Resource Management Techniques for Supporting Data Analytics - Case Study: Management of Sensor-Based Bridges - Case Study: Research Collaboration Platform for Management of Smart Machinery

TEXT BOOK:

1. RajkumarBuyya, Amir VahidDastjerdi, "**Internet of Things Principles and Paradigms**", TODD GREEN publications, 2016. Chapters:1-10

Reference Books

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.

2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.

3. Jan Ho¨ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

4. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press - 2010.

5. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012

Video References:Lecture Videos: https://nptel.ac.in/courses/106105166/

Course outcomes:

On the successful completion of the course, students will be able to:

CO1:	Role –Play the IOT Ecosystem Concepts and Architectures	K1, K2	LO
CO2:	Relate and apply the enabling Technology for the Cloud of Things	K3	IO
CO3:	Discover the IOT based application for customized solutions	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	M	S	S	M	-	-	-	M	-	-	-
CO2	L	M	M	S	M	-	-	-	L	-	-	-
CO3	L	M	L	S	L	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

COURSE-18UPCSC1E14 **Credits: 3**

SOFTWARE PROJECT MANAGEMENT

OBJECTIVES:

- To outline the basic concepts of Software Project Management
- To highlight techniques for software cost estimation and activity planning.

UNIT I:

Importance of Software Project Management–Activities Methodologies–Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management–Stepwise ProjectPlanning.

UNIT II:

Software process and Process Models – Choice of Process models – incremental delivery–Rapid Application development– Agile methods–Extreme Programming–SCRUM–Managing interactive processes–Basics of Software estimation–Effort and Cost estimation techniques– COSMIC Full function points–COCOMO II A Parametric Productivity Model–Staffing Pattern.

UNIT III:

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling–Network Planning models–Forward Pass &Backward Pass techniques–Critical path(CRM) method–Risk identification–Assessment–Monitoring –PERT technique–Monte Carlo simulation– Resource Allocation–Creation of critical patterns– Cost schedules.

UNIT IV:

Framework for Management and control – Collection of data Project termination–Visualizing progress– Cost monitoring –Earned Value Analysis-Project tracking –Change control- Software Configuration Management–Managing contracts– Contract Management.

UNIT V:

Managing people – Organizational behavior – Best methods of staff selection–Motivation–The Oldham- Hackman job characteristic model– Ethical and Programmed concerns–Working in teams–Decision making –Team structures–Virtual teams–Communications genres– Communication plans.

TEXTBOOK:

1.Bob Hughes, MikeCotterellandRajibMall: Software Project Management– Fifth Edition,Tata McGraw Hill, NewDelhi, 2012.

Chapters:
Unit I: 1.2, 1.6-1.8, 1.10, 1.13, 1.14, 2.3, 2.5, 2.6, 2.9, 3.1.
Unit II: 4.4, 4.5, 4.11, 4.13-4.17, 5.4, 5.5, 5.12, 5.13, 5.15.
Unit III: 6.2, 6.4-6.7, 6.10-6.12, 7.5, 7.6, 7.10, 7.11, 8.1, 8.5, 8.9
Unit IV: 9.2, 9.3, 9.5-9.8, 9.10-9.12, 10.5
Unit V: 11.1, 11.3-11.7, 11.10, 12.3, 12.4, 12.6-12.8.

REFERENCES:
1. Robert K.Wysocki-EffectiveSoftwareProjectManagement– WileyPublication, 7th Edition 2014.
2. WalkerRoyce: –SoftwareProject Management -Addison-Wesley, 5th Edition, 2013.
3. GopalaswamyRamesh,-ManagingGlobalSoftwareProjects – McGraw Hill Education(India),Fourteenth Reprint 2013.

Course outcomes:

On the successful completion of the course, students will be able to:

CO1:	Comprehend the software process and software project management	K1, K2	LO
CO2:	Apply requirements analysis while developing and maintaining the software	K3	IO
CO3:	Examine and evaluate software project	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	M	S	M	L	-	-	-	M	-	-	-
CO2	S	M	S	M	M	-	-	-	-	-	-	-
CO3	L	S	S	L	S	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

COURSE-18UPCSC1E15 **Credits: 3**

NETWORK PROGRAMMING

Objectives:

- Learning the Unix operating system and its programming environment.
- Understanding the user/kernel interface, fundamental concepts of Unix, user authentication, basic and advanced I/O, file systems, signals, process relationships, and inter-process communication.
- Fundamental concepts of software development and maintenance on Unixsystems.

Unit-I

Introduction: UNIX Architecture-Logging In–Files and Directories–Input and Output –Programs and Processes–Error handling –User Identification– Signals– Time values– System Calls and Library functions–Standards and Implementation: UNIX Standardization– Implementations–Limits– ProcessEnvironment:main()–Processstermination–Command line arguments– Environmentlistandvariables.ProcessControl:Identifiers–fork(),vfork(),exit(), wait().

Chapters: 1, 2.2, 2.3, 2.5, 7.2 to 7.5, 7.9, 8.2 to 8.8

Unit-II

exec functions – Changing User IDs and Group IDs – System function – Process accounting–User identification–Process times. Process relationships: Terminal logins– Network logins– Process groups– Sessions– Controlling terminals– tcgetpgrp( ),tcsetpgrp()– Jobcontrol–Shell execution of programs–Orphaned process groups. Daemon Processes: Characteristics–Coding rules.

Chapters: 8.10, 8.11, 8.13 to 8.16, 9.2 to 9.10, 13.2, 13.3

Unit-III

Socket Introduction: Socket address structure – Byte ordering and manipulation functions– Addressconversionsfunctions.ElementaryTCPsockets:Introduction–socket, connect, bind, listen, accept, close functions – Concurrent server – Server host crashes, rebooting and shut down.I/O multiplexing:I/O models– select ()– shutdown () – poll(). Chapters: 3.1 to 3.8, 4.1 to 4.6, 4.8, 5.14 to 5.16, 6.2, 6.3, 6.6, 6.10

Unit-IV

Socketoptions: getsocket() and setsocket()–Generic socket options–IPsocket options (IPv4 andIPv6) – ICMP socket options –TCP socket options. Elementary UDP sockets: recv from and send to functions–Lost datagrams–Verifying received response–Server not Running–connect() with UDP–Lack of flow control–

Determining outgoing interface–TCP and UDP echo server using select()– DNS–gethost by name()–gethosbyaddr ()– get sebyname()and get servbyport().
Chapters: 7.1 to 7.2, 7.2, 7.5 to 7.9, 8.2, 8.7 to 8.9, 8.111, 8.13 to 8.15, 11.2 to 11.5

Unit-V

IPv4and IPv6 interoperability–Routing sockets–Key management sockets: Reading and Writing–SADB–SA–MaintainingSAs–Broadcasting:Address–UnicastVsBroadcast –Multicasting: Multicast Vs Broadcast–Multicasting on LAN–Multicasting on WAN– Threads: Creationand Termination–Raw sockets: Creation–Input–Output–ping program– trace route program.
Chapters: 12, 18, 19.2 to 19.5, 20.2, 20.3, 21.2 to 21.4, 26.2, 28.2 to 28.6

TextBooks:

1. W. Richard Stevens, Stephen A. Rago, -Advanced Programming in the UNIX Environment‖, Second Edition, Pearson Education, New Delhi, 2007.
(UnitsIandII)
2. W.R.Stevens,B.Fenner,A.M.Rudoof,-UNIXNetworkProgramming‖VolumeI,Third Edition, PHIPrivateLtd ,NewDelhi, 2005. (Units IIIto V)

Reference Books:

1. Sumitabha Das, –Your UNIX the ultimate Guide,Tata McGraw Hill, 2002
2. Ashok Arora,S. Bansal,-UNIX and C ProgrammingFirst edition,Firewall media, 2005.

Course outcomes:

On the successful completion of the course, students will be able to:

CO1:	Apprehend functions of Unix operating system and its programming environment	K1, K2	LO
CO2:	Design and maintain the network	K3	IO
CO3:	Create and maintain the applications in Unix systems	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	S	S	S	-	-	-	M	-	-	-
CO2	M	S	M	S	M	-	-	-	M	-	-	-
CO3	L	S	L	M	L	-	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

COURSE-18UPCSC1E16 **Credits: 3**

NATURAL LANGUAGE PROCESSING

Course Objectives:

- Provide the student with knowledge of various levels of analysis involved in NLP
- Understand the applications of NLP
- Gain knowledge in automated Natural Language Generation and Machine Translation

UNIT I –OVERVIEW AND MORPHOLOGY

Introduction – Models and Algorithms – Regular Expressions – Basic Regular Expression Patterns – Finite-State Automata – Morphology – Inflectional Morphology – Derivational Morphology – Finite-State Morphological Parsing – Porter Stemmer

UNIT II– WORD LEVEL AND SYNTACTIC ANALYSIS

N-grams – Counting Words in Corpora – Unsmoothed N-grams – Smoothing – Backoff – Deleted Interpolation – Entropy – English Word Classes – Tagsets for English – Part of Speech Tagging – Rule Based Part of Speech Tagging – Stochastic Part of Speech Tagging – Transformation-Based Tagging

UNIT III – CONTEXT FREE GRAMMARS

Context Free Grammars for English – Context Free Rules and Trees – Sentence-Level Constructions – The Noun Phrase – Coordination – Agreement – The Verb Phrase and Subcategorization – Parsing as Search – A Basic Top-down Parser – The Earley Algorithm – Finite-State Parsing Methods

UNIT IV – SEMANTIC ANALYSIS

Representing Meaning – Computational Desiderata – Meaning Structure of Language – First Order Predicate Calculus – Representing Linguistically Relevant Concepts – Syntax-Driven Semantic Analysis – Semantic Attachments – Integrating Semantic Analysis – Robust Semantic Analysis

UNIT V –LANGUAGE GENERATION AND DISCOURSE ANALYSIS

Discourse: Reference Resolution – Text Coherence – Discourse Structure – Coherence – Dialog and Conversational Agents: Dialog Acts – Interpretation – Conversational Agents – Language Generation – Architecture – Surface

Realizations – Discourse Planning – Machine Translation: Transfer Metaphor – Interlingua – Statistical Approaches.

TEXT BOOKS:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2008.

Unit-I : (Chapters: 1, 2, 3) Unit-II : (Chapters: 6, 7, 8) Unit-III : (Chapters: 9, 10)

Unit-IV : (Chapters: 14, 15, 16) Unit-V : (Chapters: 18, 19, 20, 21)

REFERENCE BOOKS:

1. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", First Edition, O'Reilly Media, 2009.
2. C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA:,1999

Course outcomes:

On the successful completion of the course, students will be able to:

CO1:	Recognize the feasibility of applying a morphology methodology	K1, K2	LO
CO2:	Analyze and integrate various context free grammar and semantic techniques.	K3	IO
CO3:	Contrast statistical and discourse analysis	K4, K5,K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	S	M	M	-	-	-	M	-	-	-
CO2	M	M	M	S	M	-	-	-	,	-	-	-
CO3	L	L	L	M	L	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

ELECTIVE – V LIST

COURSE-18UPCSC1E17 **Credits: 3**

SOFT COMPUTING

Course Objective:

1. The primary objective of this course is to provide an introduction to the basic principles, techniques, and applications of soft computing.
2. To understand the basic Concept of neural network, various models of Neural networks and supervised and unsupervised learning techniques.
3. Provide the mathematical background for carrying out the optimization associated with neural network learning.
4. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
5. To get familiar with the basis of Fuzzy logic , fuzzy relations, fuzzy inference system and defuzzification techniques.

UNIT – I

Introduction: Neural Networks – Application scope of Neural Networks – Fuzzy Logic. Artificial Neural Networks: Fundamental Concept – Evaluation Neural Networks – BasicModels of Artificial Neural Networks: Learning - Terminologies of ANNs - McCullochPitts Neuron - Linear Separability - Hebb Network.

UNIT – II

Supervised Learning Network: Perceptron Networks – Adaptive Linear Neuron - Multiple Adaptive Linear Neurons – Back-Propagation Networks.Associative Memory Networks: Introduction – Training Algorithm for Pattern Association – Hopfield Networks: Discrete Hopfield Networks – Continuous Hopfield Networks.

UNIT – III

Unsupervised Learning Network: Introduction – Maxnet – Maxican Hat Net – Hamming Network - Kohonen Self-Organizing Feature Maps - Learning Vector Quantization- Adaptive Resonance theory Network.

UNIT – IV

Fuzzy logic: Introduction – Classical Sets – Fuzzy Sets. Fuzzy Relations: Cardinality of Fuzzy Relation – Operations and properties of Fuzzy Relations – Fuzzy Composition – Tolerance and Equivalence Relations - Noninteractive fuzzy sets. Membership Functions: Introduction – Features of Membership functions – Fuzzification.

UNIT – V

Defuzzification: Introduction – Lambda cut for Fuzzy Sets and Relations – Defuzzification Methods. Fuzzy Arithmetic and Fuzzy Measures: Introduction – Fuzzy Arithmetic – Fuzzy Measures.

Text Book:

1. S. N. Sivanandam and S. N. Deepa, **"Principles of Soft Computing",** Wiley, Third Edition, 2018.

Unit I: **Chapter 1:** 1.1, 1.2, 1.3. **Chapter 2:** 2.1, 2.2, 2.3 (2.3.2, 2.3.3), 2.4, 2.5, 2.6, 2.7

Unit II: **Chapter 3:** 3.1, 3.2, 3.3, 3.4, 3.5, **Chapter 4:** 4.1, 4.2, 4.6 (4.6.1, 4.6.2)

Unit III: **Chapter 5:** 5.1, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.4, 5.6

Unit IV: **Chapter 10:** 10.1, 10.2, 10.3, **Chapter 11:** 11.4, 11.5, 11.6, **Chapter 12:** 12.1, 12.2, 12.3

Unit V: **Chapter 13:** 13.1, 13.2, 13.3, 13.4, **Chapter 14:** 14.1, 14.2, 14.4

Reference Books:

1. SarojKaushik, SunitaTewari, **"Soft Computing",**Mcgrawhill, First edition, 2018.

2. Timothy J. Ross, **"Fuzzy Logic with Engineering Applications"**, 4th Edition, Wiley, 2016.

3. Dilip K. pratihar, **"soft computing : fundamental & APPLICATION",** First Edition, Narosa, 2015.

4. Padhy N. P. and S. P. Simon, **"Soft Computing: With Matlab Programming",** OUP India, 2015.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Recognize the feasibility of applying a soft computing methodology for a particular problem. Conceptualize and parameterize various problems to be solved through basic soft computing techniques.	K1, K2	LO
CO2	Apply and integrate various soft computing techniques in order to solve problems effectively and efficiently. Apply neural networks to pattern classification.	K3	IO
CO3	Review the use of existing software tools to solve real problems using a soft computing approach. Evaluate and compare solutions by various soft computing approaches for a given problem.	K4 K5, K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	-	-	M	-	-	M	-	-	-	-	-
CO2	S	M	M	M	M	-	M	-	-	-	-	-
CO3	S	M	M	M	S	-	M	-	-	L	-	M

S- Strong; M-Medium; L-Low

COURSE-18UPCSC1E18 **Credits: 3**

DEEP LEARNING

Unit -I

Deep Learning: AI and deep learning - The history and rise of deep learning - Why Deep Learning? - The motivation of deep architecture – Applications - Future potential and challenges.

Getting Yourself Ready for Deep Learning: Basics of linear algebra - Deep learning with GPU - Deep learning software frameworks - Setting up deep learning on AWS

Unit -II

Getting Started with Neural Networks: Multilayer perceptrons - How a network learns - Deep learning models - Practical examples - Deep Learning in Computer Vision: Origins of CNNs- Convolutional Neural Networks -Fine-tuning CNNs - Popular CNN architectures

Unit –III

NLP - Vector Representation: Traditional NLP - Deep learning NLP – Applications. - Advanced Natural Language Processing: Deep learning for text - Recurrent neural networks - Long short-term memory network – Applications

Unit –IV

Multimodality: What is multimodality learning? - Challenges of multimodality learning- Image captioning - Visual question answering - Multi-source based self-driving - Deep Reinforcement Learning: What is reinforcement learning (RL)? - Deep reinforcement learning - Implementing reinforcement learning

Unit – V

Deep Learning Hacks: Massaging your data - Tricks in training - Fine-tuning - Model compression - Deep Learning Trends: Recent models for deep learning - Novel applications

TEXT BOOK:

1. Anurag Bhardwaj, Wei Di, Jianing Wei, "**Deep Learning Essentials**", Packt Publishing, 2018. Chapters:1-10

References

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016..
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Describe the history and motivation of deep learning	K1, K2	LO
CO2:	Illustrate the concepts neural network and computer vision	K3	IO
CO3:	Analyze language processing and representation. Illustrate multimodality, reinforcement learning and Examine the concepts deep learning hack and trends	K4, K5 and K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	L	L	-	S	-	S	-	S	-
CO2	S	S	M	M	L	-	M	-	S	-	S	-
CO3	S	S	M	L	S	-	M	-	M	-	S	-

S- Strong; M-Medium; L-Low

Course Code-18UPCSC1E19 **Credits:3**

ARTIFICIAL NEURAL NETWORK

Course objectives

- Aims to provide an in-depth knowledge of artificial neural network and fuzzy logic
- Helps to learn the various artificial neural network models along with learning algorithms

Syllabus

UNIT – I

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process.

UNIT – II

Single Layer Perceptron: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron – Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection.

UNIT – III

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues, and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning.

UNIT – IV

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification.

UNIT – V

Dynamic Programming : Markov Decision Process- Bellman,s Optimality Criterion- Approximate Dynamic Programming : Direct Method- Approximate Dynamic Programming : In-Direct Method -Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models, Computer Experiment

TEXT BOOK:

1. Simon Haykin, Neural Networks a Comprehensive Foundations, Thrid Edition, PHI edition, 2009. Chapters 1-4, 9,12,13

REFERENCE BOOKS:

1. B. Yegnanarayana, “Artificial Neural Networks”, PHI Pvt Ltd, 2005
2. Li Min Fu, “Neural Networks in Computer Intelligence”, TMH, 2003
3. Jacek M. Zurada, “Introduction to Artificial Neural Systems”, JAICO Publishing House Ed. 2006.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand the differences between networks for supervised and unsupervised learning	K1, K2	LO
CO2:	Apply and illustrate single and multi-layer feed-forward neural networks.	K3	IO
CO3:	Analyze the performance of Artificial Neural Networks models, characteristics of ANN’s learning strategies and learning rules	K4, K5 and K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M-	-	-	-	-	-	-	-	-	-
CO2	S	M	S	M	-	-	-	-	M	-	L	-
CO3	S	M	S	M	-	-	-	-	M	-	L	-

S- Strong; M-Medium; L-Low

COURSE-18UPCSC1E20 **Credits: 3**

MACHINE LEARNING TECHNIQUES

Objectives:

- To Learn about Machine Intelligence and Machine Learning applications
- To implement and apply machine learning algorithms to real-world applications.
- To identify and apply the appropriate machine learning techniques to classification, pattern recognition, optimization and decision problems.
- To understand how to perform evaluation of learning algorithms and model selection.
- To make the students understand different regression models.
- To implement the WEKA tool for validating logical regressions

Unit I SIMPLE LINEAR REGRESSION: Introduction to Simple Linear Regression-The Least-Squares Estimates- Dangers of Extrapolation- The Coefficient of Determination, r-Standard Error of the Estimate s- Correlation Coefficient r-ANOVA Table for Simple Linear Regression- Outliers, High Leverage Points, and Influential Observations-Population Regression Equation-Verifying the Regression Assumptions- Inference in Regression-t-Test for the Relationship Between x and y -Confidence Interval for the Slope of the Regression Line - Confidence Interval for the Correlation Coefficient ρ - Confidence Interval for the Mean Value of y Given x - Prediction Interval for a Randomly Chosen Value of y Given x - Transformations to Achieve Linearity-Box–Cox Transformations.

Unit II MULTIPLE REGRESSION AND MODEL BUILDING: Introduction to Multiple Regression-The Population Multiple Regression Equation-Inference in Multiple Regression- Regression with Categorical Predictors, Using Indicator Variables-Adjusting R2: Penalizing Models for Including Predictors that are not Useful- Sequential Sums of Squares- Multicollinearity- Variable Selection Methods- An Application of Variable Selection Methods- Using the Principal Components as Predictors in Multiple Regression.

Unit III LOGISTIC REGRESSION: Simple Example of Logistic Regression-Maximum Likelihood Estimation- Interpreting Logistic Regression Output-Odds Ratio and Relative Risk-Interpreting Logistic Regression for a Dichotomous Predictor-Interpreting Logistic Regression for a Polychotomous Predictor-Interpreting Logistic Regression for a Continuous Predictor- Assumption of Linearity-Zero-Cell Problem- Multiple Logistic Regression- Introducing Higher Order Terms to Handle Nonlinearity - Validating the Logistic Regression Model-WEKA: Hands-On Analysis Using Logistic Regression.

Unit IV NAIVE BAYES AND BAYESIAN NETWORKS: Bayesian Approach- Maximum a Posteriori (Map) Classification- Posterior Odds Ratio- Balancing the Data- Naïve Bayes Classification- Interpreting the Log Posterior Odds Ratio- Zero-Cell Problem - Numeric Predictors for Naïve Bayes Classification- WEKA: Hands-on Analysis Using Naïve Bayes- Bayesian Belief Networks - Clothing Purchase Example- Using the Bayesian Network to Find Probabilities.

Unit V GENETIC ALGORITHMS: Introduction to Genetic Algorithms-Basic Framework of a Genetic Algorithm- Simple Example of a Genetic Algorithm at Work - Modifications and Enhancements: Selection-Modifications and Enhancements: Crossover- Genetic Algorithms for Real-Valued Variables- Using Genetic Algorithms to Train a Neural Network - WEKA: Hands-On Analysis Using Genetic Algorithms- Case Study: Clustering and Principal Components Analysis

Text Book

Daniel T. Larose , Chantal D. Larose, Data mining and Predictive analytics, Second Ed., Wiley Publication, 2015.**Chapters:** 8, 9, 13,14,27,30.

Reference

1. Bertt Lantz, Machine Learning with R: Expert techniques for predictive modeling, 3rd Edition, April 15, 2019,

2. Jason Bell, Machine Learning: Hands-On for Developers and Technical Professionals, Wiley Publication, 2015.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand the core concepts and recognize the feasibility of applying a machine learning techniques for a particular problem .	K1, K2	LO
CO2:	Apply and integrate various machine learning techniques in order to solve problems effectively and efficiently.	K3	IO
CO3:	Illustrate the linear regression, multiple regression and logistic regression. Evaluate and compare solutions by various machine learning approaches for a given problem.	K4, K5 and K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	M	M	M	-	M	-	-	-	-	-
CO3	S	M	M	M	M	-	M	-	-	L	-	M

S- Strong; M-Medium; L-Low

ELECTIVE – VI LIST

COURSE-18UPCSC1E21 **Credits: 3**

MOBILE COMPUTING

Course Objective:

- To introduce the concepts of wireless devices with signal, Antenna, Radio Frequencies, Signal Propagation.
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, Wireless LAN, GSM, CDMA.
- To introduce the WAP Architecture, MANET and Routing

Unit-I

Introduction – Applications – History of wireless communication – A Simplified reference model - Wireless transmission – Frequencies for radio transmission – Regulations – Signals –Antennas - Signal propagation: Path loss of radio signals - Additional signal propagation effects - Multi-path propagation – Multiplexing - Modulation

Chapters: 1, 2.1 to 2.6

Unit-II

Spread spectrum – Direct sequence spread spectrum – Frequency hopping spread spectrum – Cellular systems. Medium access control: Hidden and exposed terminals – Near and far terminals – SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, slotted Aloha, Carrier sense multiple access – Reservation TDMA – Multiple access with collision avoidance – Polling – CDMA – Spread Aloha multiple access.

Chapters: 3.1 to 3.3, 3.4.1 to 3.4.4, 3.4.7 to 3.4.9, 3.5.1

Unit-III

GSM - Mobile services – System architecture – Radio interface – Protocols – Localization and calling – Handover – Security – New Data services. UMTS and IMT-2000 - Satellite Systems: Applications – Basics – Routing – Localization – Handover.

Chapters: 3.6, 4.1.1 to 4.1.8, 4.4, 5.2 to 5.6

Unit-IV

Wireless LAN: Infra red vs. radio transmission – Infrastructure and ad-hoc network – IEEE 802.11 – System architecture – Protocol architecture – Physics layer – Medium access control layer – MAC management – Blue tooth. Mobile network layer: Mobile IP: Goals, assumptions and requirements – entities and terminology – packet delivery – Agent discovery – Registration – Tunneling and encapsulation Recent technologies

Chapters: 7.1 to 7.3.5, 7.5, 8.1.1 to 8.1.6

Unit-V

WAP: Architecture – wireless datagram Protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Mobile ad-hoc networks – MANET Characteristics – Classification of MANETs, Routing of MANETs, Proactive Routing Protocol - DSDV, Reactive Routing Protocols – DSR, AODV. Chapter10.3.1 to 10.3.6 (Text Book 2- 6.1, 6.2, 6.4, 6.5, 6.6)

Course Outcomes:

- On the successful completion of the course, students will be able to:
- Understanding the basic concepts of Wireless Communication
- Understanding the basic concepts of Spread Spectrum
- Analyzing the concepts of Medium Access Control
- Analyzing the concepts of Global System for Mobile Communication
- Understanding the basic concepts of Wireless LAN
- Understanding the basic concepts of Mobile Network Layer
- Understanding the basic concepts of Wireless Application Protocol
- Analyzing the concepts of Routing Protocols in MANET

Text Book:

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2009.
2. KumKumGarg, "Mobile Computing Theory and Practice", Pearson Education, 2014.

Reference Books:

1. Rifaat A. Dayen "Mobile Data & Wireless LAN Technologies", Prentice Hall, 1997.
2. Steve Mann and Scoot Schibli, "The Wireless Application Protocol", John Wiley &inc., 2000.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand the core concepts and recognize the changes of mobile computing technology.	K1, K2	LO
CO2:	Design and simulate the mobile computing models	K3	IO
CO3:	Examine the mobile computing techniques to create the mobile computing applications	K4, K5 and K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	M	M	M	-	M	-	-	-	-	-
CO3	S	M	M	M	M	-	M	-	-	L	-	M

S- Strong; M-Medium; L-Low

COURSE-18UPCSC1E22 **Credits: 3**

CYBER SECURITY

Objectives:

- To understand Cyber security Theories, Methods and Forensics.
- To understand necessary Approaches and Techniques to build protection mechanisms for Cyber crime.
- To know about the Cyber Investigation, Law and Crime.

Unit – I

Introduction to cyber crime: Classification of cyber crimes – reasons for commission of cyber crime – malware and its type – kinds of cyber crime – authentication – encryption – digital signatures – antivirus – firewall – steganography – computer forensics – why should we report cyber crime – introduction counter cyber security initiatives in india – generating secure password – using password manager-enabling two-step verification – security computer using free antivirus.

Unit – II

Tips for buying online:Clearing cache for browsers – wireless LAN-major issues with WLAN-safe browsing guidelines for social networking sites – email security tips – introduction-smartphone security guideling – purses,wallets,smartphones – platforms,setup and installation-communicating securely with a smartphone.

Unit – III

Cyber investigation roles**:** Introduction – role as a cyber crime investigator – the role of law enforcement officers – the role of the prosecuting attorney – incident response: introduction-postmortmem versus live forensics – computer analysis for the hacker defender program-network analysis – legal issues of intercepting wifi transmission – wifi technology – wifi RF-scanning RF – eavesdropping on wifi – fourth amendment expectation of privacy in WLAN.

Unit – IV

Seizure of digital information: introduction – defining digital evidence – digital evidence seizure methodology – factors limiting the wholesale seizure of hardware – other options for seizing digital evidence – common threads within digital evidence seizure – determining the most appropriate seizure method– conducting cyber investigations–demystifying computer/cyber crime – IP addresses – the explosion of networking – interpersonal communication.

Unit – V

Digital forensics and analyzing data: introduction – the evolution of computer forensics–phases of digital forensics-collection – examination-analysis – reporting – Cyber crimeprevention:introduction – crime targeted at a government agency.

Text books:

1. Dr.JeetendraPande, **"**Introduction to Cyber Security" Published by Uttarakhand Open University, 2017.(Chapter: 1.2-6.4, 9.3-12.2)
2. Anthony reyes, Kevin o'shea, Jim steele, Jon R. Hansen, Captain Benjamin R. Jean Thomas Ralph, "Cyber-crime investigations" bridging the gaps between security professionals, law enforcement, and prosecutors, 2007.(Chapter: 4, 5, 6, 7, 8, 9, 10)

Reference Books:

1. Sebastian Klipper "Cyber Security" EinEinblick fur WirtschaftswissenschaftlerFachmedien Wiesbaden, 2015
2. John G.Voller Black and Veatch "Cyber Security" Published by John Wiley & Sons, Inc., Hoboken, New Jersey Published simultaneously in Canada © 2014.

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Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Describe the basics of Cyber security concepts and Implementation in India	K1, K2	LO
CO2:	Demonstrate the security tips in browsers, WLAN, social networks, Email security and Smart phone. Apply the investigations in post mortem and forensics	K3	IO
CO3:	Examine the various Investigation roles, response. Evaluate the information and devices to conduct the investigations. Explain the forensics data and evaluate the forensics reports	K4, K5 and K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	-	L	M	L	M	M	-	M	-	-
CO2	M	S	-	L	M	L	M	M	-	M	-	-
CO3	M	S	L	L	M	L	M	M	-	M	M	L

S- Strong; M-Medium; L-Low

COURSE - 18UPCSC1E23 **Credits: 3**

EMBEDDED COMPUTING

Course Objective:

- To understand the basics of embedded computing and its environment.
- To know the architecture of embedded systems and the different applications.

Unit-I

An Introduction to Embedded Processing: Embedded Computing, Distinguishing Between Embedded and General - Purpose Computing – Characterizing Embedded Computing – Embedded Market Structure.

An Overview of VLIW and ILP: Semantics and Parallelism – Design Philosophies – Role of the Compiler – VLIW in the Embedded and DSP Domains – Historical Perspective and Further Reading.

Unit-II

An Overview of ISA Design: Overview – Basic VLIW Design Principles – Designing a VLIW ISA for Embedded Systems – Instruction-set Encoding – VLIW Encoding – Encoding and Instruction-set Extensions.

Architectural Structures in ISA Design: The Datapath- Registers and Clusters – Memory Architecture – Branch Architecture – Speculation and Predication – System Operations.

Unit-III

Microarchitecture Design: Register File Design – Pipeline Design – CLIW Fetch, Sequencing, and Decoding – The Datapath – Memory Architecture – The Control Unit – Control Registers – Power Considerations.

System Design and Simulation: System-on-a-Chip (SoC) – Processor Cores and SoC – Overview of Simulation - Simulating a VLIW Architecture – System Simulation – Validation and Verification.

Unit-IV

Embedded Compiling and Tool chains: Introduction – Embedded Cross-Development Toolchains – Structure of an ILP Compiler – Code Layout – Embedded-Specific Tradeoffs for Compilers – DSP-Specific Compiler Optimizations.

Compiling for VLIWs and ILP: Profiling – Scheduling – Register Allocation – Speculation and Predication – Instruction Selection.

Unit-V

The Run-time System: Exceptions, Interrupts, and Traps – Application Binary Interface Considerations – Code Compression – Embedded Operating Systems – Multiprocessing and Multithreading.

Application Areas: Digital Printing and Imaging – Telecom Applications – Other Application Areas: Digital Video – Automotive – Hard Disk Drives – Networking and Network Processors.

TEXT BOOK

1. Joseph A. Fisher, Paolo Faraboschi, Cliff Young, Embedded Computing: AVLIW Approach to Architecture, Compilers, and Tools, Morgan Kaugmann Publishers An imprint of Elsevier, Elsevier Inc., 2008.
(Chapters: 1, 2, 3, 4, 5, 6, 7, 8, 9, 11)

REFERENCE BOOKS

1. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.
2. Jane.W.S. Liu Real-Time systems, Pearson Education Asia, 2000
3. C. M. Krishna and K. G. Shin , Real-Time Systems, ,McGraw-Hill, 1997

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand and recognize the basics of embedded computing environment with its technology	K1, K2	LO
CO2:	Demonstrate the various embedded computing models and apply in to the real world examples	K3	IO
CO3:	Evaluate the models and create the new models for real world applications.	K4, K5 and K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	-	L	M	L	M	M	-	M	-	-
CO2	M	S	-	L	M	L	M	M	-	M	-	-
CO3	M	S	L	L	M	L	M	M	-	M	M	L

S- Strong; M-Medium; L-Low

COURSE-18UPCSC1E24 **Credits: 3**

DATA VISUALISATION

Course Objective:

- To develop skills to both design and critique visualization
- To understand why visualization is an important part of data analysis
- To understand the components involved in visualization design
- To understand the type of data impacts the type of visualization

Unit-I

Data Preparation :Importing Data - Text files -Excel spreadsheets -Statistical packages - Databases - Cleaning Data : Selecting variables - Selecting observations - Creating/Recoding variables - Summarizing data - Using pipes - Reshaping data - Missing data - Introduction to ggplot2 -ggplot- geoms - grouping scales - facets -labels- themes - Placing the data and mapping options-Graphs as objects

Unit-II

Univariate Graphs - Categorical : Bar Chart -Pie Chart - Tree Map- Quantitative - Histogram - Kernel Density plot - Dot Chart - Bivariate Graphs - Categorical vs. Categorical : Stacked bar chart - Grouped bar chart - Segmented bar chart - Improving the color and labeling - Other plots - Quantitative vs. Quantitative :Scatterplot - Line plot- Categorical vs. Quantitative: Bar chart (on summary statistics) - Grouped kernel density plots - Box plots -Violin plots -Ridgeline plots - Mean/SEM plots - Strip plots - Beeswarm Plots -Cleveland Dot Charts - Multivariate Graphs - Grouping - Faceting

Unit- III

Maps: Dot density maps-Choroplethmaps:Data by country-Data by US state-Data by US county -Time-dependent graphs: Time series- Dummbbell charts - Slope graphs - Area Charts - Statistical Models : Correlation plots - Linear Regression - Logistic regression - Survival plots - Mosaic plots

Unit- IV

3-D Scatterplot : Biplots - Bubble charts - Flow diagrams -Sankey diagrams- Alluvial diagrams - Heatmaps - Radar charts - Scatterplot matrix - Waterfall charts- Word clouds -Customizing Graphs - Axes: Quantitative axes -

Categorical axes - Date axes- Colors: Specifying colors manually-Color palettes: Points & Lines: Points - Lines - Fonts - Legends: Legend location- Legend title - Labels- Annotations: Adding text - Adding lines - Highlighting a single group - Themes- Altering theme elements - Pre-packaged themes

Unit- V

Saving Graphs : Via menus - Via code - File formats -External editing - Interactive Graphs - leaflet - plotly -rbokeh - rCharts - highcharter- Best Practices: Labeling - Signal to noise ratio - Color choice- y-Axis scaling - Attribution

Text Book

1. Rob Kabacoff , Data Visualization with R, Bookdown, 2018. Chapters: 1-13

https://rkabacoff.github.io/datavis/

Reference

1. KirthiRaman - Mastering Python Data Visualization - Packt Publishing - 2015

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Describe the concepts of data preparation and categorize the data.	K1, K2
CO2:	Illustrate the map and scatter plot	K3
CO3:	Analyze the data using various chart and Review the chart based on the problem. Evaluate and compare solutions by best practice.	K4,K5 and K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	M	M	M	-	M	-	-	-	-	-
CO3	S	M	M	S	M	-	S	-	-	L	-	M

S- Strong; M-Medium; L-Low