PERIYAR UNIVERSITY

Periyar Palkalai Nagar, Salem-636011

(NAAC A GRADE – STATE UNIVERSITY – NIRF RANK 68)

DEPARTMENT OF COMPUTER SCIENCE

M.Sc. DEGREE

COMPUTER SCIENCE

[Choice Based Credit System (CBCS)]

OBE REGULATIONS AND SYLLABUS

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

M. Sc. COMPUTER SCIENCE

OBE REGULATIONS AND SYLLABUS

(With effect from the academic year 2018-2019 onwards)

1. Preamble

To Develop the Post Graduates in **Computer Science** with deep knowledge of theoretical computer science who can be employed in academic institutions and research and development units of industries.

2. *General Graduate Attributes*

***GA1 :* Apply Mathematical Knowledge**

Graduates will be able to apply mathematics, and statistics to the design and development of software systems.

GA2 : Develop Softwares based on Software Engineering principles

Graduates will be able to design and develop computer software systems based on the acquired knowledge in Programming Languages and based on Software Engineering.

GA3 : Develop Research skills

Graduates will be able to exhibit the research skills in various areas and update their skills based on recent advances in research field.

GA4 : Understanding of Profession Ethics

Graduates will exhibit an understanding of professional ethics and the roles of regulations and guidelines in the profession.

GA 5: Solve computer science problems

Be equipped with a range of fundamental principles of Computer Science that will provide the basis for future learning and enable them to adapt to the constant rapid development of the field.

Be able to apply mathematics, logic, and statistics to the design, development, and analysis of software systems.

GA 6: To apply algorithmic principles

To Identify the key intellectual themes of the field in algorithmic thinking, information representation, and computer programs.

GA 7: To acquire the latest technical skills

To enable the students to acquire the latest technical skills and build their carrier on the basis of continuous learning and adaptability.

GA 8: Leadership, initiative and teamwork:

To inculcate the Ability to work effectively in a team and lead in multidisciplinary environment.

GA 9: Kindle Creativity

To demonstrate critical thinking, imagination and intellectual agility and strive to be innovative and experimental in advancing knowledge and in creating solutions.

GA 10: Enhance the knowledge in Specialization area:

To enhance the knowledge in their specialist area and apply Analytical approach to identify and resolve problems.

GA 11: Persuade Intellectual Rigour

An ability to think clearly and deeply with rigour when faced with new knowledge and arguments and demonstrate the ability to apply research results to solve problems.

GA 12: Communication and social skills

To impart Good communication and social skills to widen the ability to listen to, as well as clearly express, information back to others in a variety of ways: oral, written, and visual - using a range of technologies.

3. Programme Specific Qualification Attributes

Mention the programme specific qualification attributes achieved through courses in the programme in terms of

- **Knowledge and understanding level (K1 and K2)**
  - Remember or recognize a term or a basic concept
  - Select an explanation for a statement related to the question topic
  - Understand the existing problems

- **Application level (K3)**
  - Be able to solve the problems using computing techniques.

- **Analytical level (K4)**
  - Be able to separate information related to a procedure or technique into its constituent parts for better understanding and can distinguish between facts and inferences.

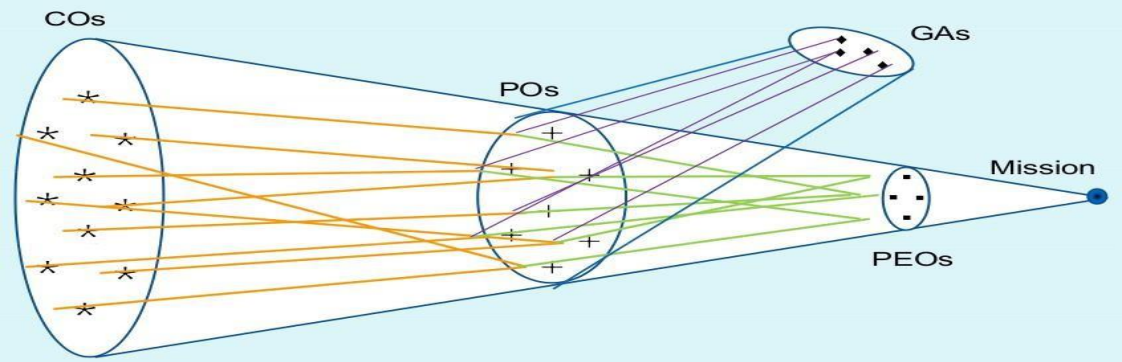
- **Evaluation capability level (K5)**
  - Be able to make judgments based on criteria and standards. Detects inconsistencies or fallacies within a process or product, determines whether a process or product has internal consistency and detects the effectiveness of a procedure as it is being implemented.

- **Scientific or synthesis level (K6)**
  - A scientific way to analyze and solve the problems.

3. Vision

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

It must be linked like this



Mission is the Programme Specific Objectives, GAs – Graduate attributes (general)

4. Programme Objectives and Outcomes

Spelt the PEOs (Programme Educational Objectives), Programme Specific Objectives (PSOs) and Programme Outcomes (POs)

Programme Educational Outcomes (PEOs) for M.Sc Computer Science are as follows

PEO1: Apply algorithmic, mathematical and scientific reasoning to a variety of computational problems

PEO2: Implement software systems that meet specified design and performance requirements.

PEO3: Work effectively in teams to design and implement solutions to computational problems

PEO4: Communicate effectively, both orally and in writing. Design, implement and document solutions to significant computational problems

Programme Specific Outcomes (PSOs) for M.Sc Computer Science are as follows

PSO1: An ability to apply profound knowledge to analyze and design software and systems containing hardware and software components of varying complexity.

PSO2: An ability to apply mathematical model, algorithmic principles, and computer science theory in the design of real-time applications

Programme Outcomes (POs) for M.Sc Computer Science are as follows

PO1: Computational Knowledge: Gain knowledge in the theoretical foundations of Computer Science, Computing Fundamentals and Basic Mathematics.

PO2: Problem Analysis: to analyze and identify the customer requirements in multidisciplinary domains, create high level design and implement robust software applications using latest technological skills.

PO3: Design and Development: design and develop solutions for complex problems in various domains. Serve as the Programmers or the Software Engineers with the sound knowledge of practical and theoretical concepts for developing software.

PO4: Research Activity: To understand the fundamentals of research and Inculcate the ability to undertake original research at the cutting edge of computer science & its related areas. Produce researchers who can investigate problems in different application domains and creatively develop, and evaluate computational solutions.

PO5: Software tool usage: To adapt and apply modern computing skills and tools to resolve problems with software development tools, software systems, and modern computing platforms.

PO6: Professional ethics: To understand professional ethics and Cyber regulations and develop youth with social commitments.

PO7: Personality development: To understand Management Principles and apply the principles to develop software as a team member and mange projects efficiently for multidisciplinary environments.

PO8: Communication and Presentation Efficacy: Communicate effectively with computing society in both verbal and written form. Improve communication and presentation skills, especially in providing technical support.

PO9: Social Responsibility: To access Social and Environmental issues for local and global needs and give relevant solutions for them. Gained the analytical ability to analyze the literature and social issues to appreciate the strength and to suggest the improvements for better results.

PO10: Entrepreneurship: Discover the opportunity for entrepreneurship and create and add value for the betterment of an individual and society at large.

PO11: Algorithmic principles and theory: An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computational systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.

PO12: Team work: Solve the problems (programming networking database and Web design) in the Information Technology environment. Function effectively on teams to accomplish a common goal and demonstrate professional behavior.

PEO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1												
PEO2												
PEO3												
PEO4												

PO-GA MAPPING:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PO1												
PO2												
PO3												
PO4												

PO5												
PO6												
PO7												
PO8												
PO9												
PO10												
PO11												
PO12												

5. Candidate's eligibility for admission

A candidate who has passed B.Sc. Computer Science/B.C.A/B.Sc. Computer Technology/B.Sc. Information Science/Technology degree of this University or any of the degree of any other University accepted by the syndicate as equivalent thereto subject to such conditions as may be prescribed therefore shall be permitted to appear and qualify for the **M.Sc. Computer Science** degree examination of this University after a course of study of two academic years.

6. Duration of the programme

The programme for the degree of **Master of Science in COMPUTER SCIENCE** shall consist of **two Academic years** divided into four semesters. Each semester consist of 90 working days.

7. CBCS- Structure of the Programme

The programme structure comprises of two parts.

Course Component	No. of Courses	Hours of Learning/ Week	Marks	Credits
Part A (Credit Courses)				
Core Courses	12	48	1200	48
Elective Courses	2	6	200	6
Supportive Courses	1	3	100	3
Core – Practical	4	4	100	8
Mini-Project	4	4	100	2
Core – Theory cum Practical	-	-	-	-
Project (Option – I) – Sem-IV	1	-	200	20
Project (Option – II) – Sem – IV	1	-	200	11

Core Course (Option – II) – Sem – IV	1	4	100	4
Elective Courses (Option – II)	1	4	100	3
– Sem – IV				
Core – Practical (Option – II) – Sem – IV	1	4	100	2
Online Courses	3	3	-	-
Total				
Part B (Self-Learning Credit Courses)				
Elective Foundation Courses				
Total				

Core Courses (CC):

Course Code	Name of the Course	Category	No. of Hours / Wee			Credits
			L	T	P	
THEORY						
18UPCSC2C01	Discrete Mathematics for	CC	3	1	-	4
18UPCSC2C02	Design and Analysis of Algorithms	CC	3	1	-	4
18UPCSC2C03	Advanced Operating Systems	CC	3	1	-	4
18UPCSC2C04	Theory of Computation	CC	3	1	-	4
18UPCSC2C05	Mobile Computing	CC	3	1	-	4
18UPCSC2C08	Web Programming	CC	3	1	-	4
18UPCSC2C09	Advanced Java Programming	CC	3	1	-	4
18UPCSC2C10	Data Mining	CC	3	1	-	4
18UPCSC2C13	Digital Image Processing	CC	3	1	-	4
18UPCSC2C14	Internet of Things	CC	3	1	-	4
18UPCSC2C15	Machine Learning	CC	3	1	-	4
18UPCSC2C16	Cryptography and Network	CC	3	1	-	4

Elective Courses (EC):

Course Code	Name of the Course	Category	No. of Hours / Wee			Credits
			L	T	P	
THEORY						
	Elective-I					
18UPCSC2E01	Operations Research	EC	3	-	-	
18UPCSC2E02	Statistical Methods					
18UPCSC2E03	Numerical Methods					
18UPCSC2E04	Compiler Design					

18UPCSC2E05 18UPCSC2E06 18UPCSC2E07 18UPCSC2E08	**Elective-II** Computer Graphics Wireless Network Cyber Security Web Services	EC	3	- -	3
18UPCSC2E09 18UPCSC2E10 18UPCSC2E11 18UPCSC2E12	**Elective-III** Optimization Techniques Soft Computing Quantum Computing Robotics	EC	3	- -	3

Supportive Courses (SC):

Course Code	Name of the Course	Category	No. of Hours /			credits
			L	T	P	
THEORY						
	Supportive-I	SC	3	-	-	3

Core - Practical (CP):

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
18UPCSC2C06	Web Technology-Lab (OPEN SOURCE)	CP	-	-	4	2
18UPCSC2C07	Algorithms-Lab (LINUX)	CP	-	-	4	2
18UPCSC2C11	Web Programming–Lab	CP	-	-	4	2
18UPCSC2C12	Advanced Java –Lab	CP	-	-	4	2
18UPCSC2C17	Image Processing Lab	CP	-	-	4	2
18UPCSC2C18	Mini Project	CP	-	-	4	2
18UPCSC2C19	Soft Skill Development-Lab	CP	-	-	4	2

Theory cum Practical (TP):

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
-	-	-	-			-

Online Courses (OC):

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
	SWAYAM/MOOC-I	OC	-	-	1	
	SWAYAM/MOOC-II	OC	-	-	1	
	SWAYAM/MOOC-III	OC	-	-	1	

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

Course	L T P	No. Hours / Week	Number of Credits
Semester-I			
Course-18UPCSC2C01 Discrete Mathematics for Computing	3+1+0	4	4
Course-18UPCSC2C02	3+1+0	4	4
Design and Analysis of Algorithms			
Course-18UPCSC2C03 Advanced Operating Systems	3+1+0	4	4
Course-18UPCSC2C04 Theory of Computation	3+1+0	4	4
Course-18UPCSC2C05 Mobile Computing	3+1+0	4	4
Course-18UPCSC2C06 Web Technology-Lab (OPEN SOURCE)	0+0+4	4	2
Course-18UPCSC2C07 Algorithms-Lab (LINUX)	0+0+4	4	2
SWAYAM/MOOC-I	0+0+2	2	
Total			24
Semester-II			
Course-18UPCSC2C08 Web Programming	3+1+0	4	4
Course-18UPCSC2C09 Advanced Java Programming	3+1+0	4	4
Course-18UPCSC2C10 Data Mining	3+1+0	4	4
Elective-I	3+0+0	3	3
Supportive-I	3+0+0	3	3
Course-18UPCSC2C11 Web Programming–Lab	0+0+4	4	2
Course-18UPCSC2C12 Advanced Java –Lab	0+0+4	4	2
Human Rights			
SWAYAM/MOOC-II	0+0+2	2	
Total			22

Semester-III			
Course-18UPCSC2C13 Digital Image Processing	3+1+0	4	4
Course-18UPCSC2C14 Internet of Things	3+1+0	4	4
Course-18UPCSC2C15 Machine Learning	3+1+0	4	4
Course-18UPCSC2C16 Cryptography and Network Security	3+1+0	4	4
Elective-II	3+0+0	3	3
Course-18UPCSC2C17	0+0+4	4	2
Image Processing Lab			
Course-18UPCSC2C18 Mini Project	0+0+4	4	2
Course-18UPCSC2C19 Soft skill development-Lab	0+0+2	2	1
SWAYAM/MOOC-III	0+0+2	2	
Total			24
Semester-IV			
Course-18UPCSC2C20 Dissertation and Viva Voce (Industry)	0+0+20	-	20
Course-18UPCSC2C21 Big Data Analytics	3+1+0	4	4
Elective-III	3+0+0	3	3
Course-18UPCSC2C22 Big Data Analytics Lab	0+0+2	4	2
Course-18UPCSC2C23 Dissertation and Viva-Voce (Research / Applications)	0+0+11	-	11
SWAYAM/MOOC-IV	0+0+2	2	
Total			20
Total no. of Credits: **Core** / **Practical** / **Elective** / **Supportive** / **Option-I/Option-II**			48 14 06 3 20
Grand Total			91

Credit Calculation

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

9. STRUCTURE OF M. Sc (Computer Science) PROGRAMME UNDERCBCS PATTERN FOR UNIVERSITY DEPARTMENT(FROM 2018 AND THEREAFTER)

CURRICULUM AND SCHEME OF EXAMINATIONS

Course	Number of Credits	Hours Per Week	Examination Duration (hrs)	Marks		
				I. A	ESE	Total
Semester-I						
Course-18UPCSC2C01 Discrete Mathematics for Computing	4	4	3	25	75	100
Course-18UPCSC2C02 Design and Analysis of Algorithms	4	4	3	25	75	100
Course-18UPCSC2C03 Advanced Operating Systems	4	4	3	25	75	100
Course-18UPCSC2C04 Theory of Computation	4	4	3	25	75	100
Course-18UPCSC2C05 Mobile Computing	4	4	3	25	75	100
Course-18UPCSC2C06 Web Technology-Lab (OPEN SOURCE)	2	4	3	40	60	100
Course-18UPCSC2C07 Algorithms-Lab (LINUX)	2	4	3	40	60	100
SWAYAM/MOOC-I						
Total	24					700
Semester-II						
Course-18UPCSC2C08 Web Programming	4	4	3	25	75	100

Course-18UPCSC2C09 Advanced Java Programming	4	4	3	25	75	100
Course-18UPCSC2C10 Data Mining	4	4	3	25	75	100
Elective-I	3	3	3	25	75	100
Supportive-I	3	3	3	25	75	100
Course-18UPCSC2C11 Web Programming–Lab	2	4	3	40	60	100
Course-18UPCSC2C12 Advanced Java –Lab	2	4	3	40	60	100
Human Rights		2	3	-	100	100
SWAYAM/MOOC-II						
Total	22					800
Semester-III						
Course-18UPCSC2C13 Digital Image Processing	4	4	3	25	75	100
Course-18UPCSC2C14 Internet of Things	4	4	3	25	75	100
Course-18UPCSC2C15 Machine Learning	4	4	3	25	75	100
Course-18UPCSC2C16 Cryptography and Network Security	4	4	3	25	75	100
Elective-II	3	3	3	25	75	100
Course-18UPCSC2C17 Image Processing Lab	2	4	3	40	60	100
Course-18UPCSC2C18 Mini Project	2	4	3	40	60	100
Course-18UPCSC2C19 Soft Skill Development-Lab	2	2	3	100	-	100
SWAYAM/MOOC-III						
Total	25					800

Semester-IV (TANSHE)						
Option-I						
Course-18UPCSC2C20 Dissertation and Viva Voce (Industry)	20	-	-	50	150	200
Option-II						
Course-18UPCSC2C21 Big Data Analytics	4	4	3	25	75	100
Elective-III	3	4	3	25	75	100
Course-18UPCSC2C22 Big Data Analytics Lab	2	4	3	25	75	100
Course-18UPCSC2C23 Dissertation and Viva-Voce (Research / Applications)	11	-	-	50	150	200
Total	20					600

Total no. of Credits	**Core**	48					
	Practical	14					
	Elective	06					
	Supportive	3					
	Option-I/Option-II	20					
Grand Total		91					2900

Supportive Course:
Students are expected to opt Supportive Course (Non major elective) offered by other departments.

I. A – INTERNAL ASSESSMENT
E. E – EXTERNAL EXAMINATIONS

The content of the syllabus and regulations may be followed for first, second, third and fourth semesters as per the regulations passed in the academic year 2015-2016.

Elective Course Code :

List of Electives

Elective Course -I

18UPCSC2E01	-	Operations Research
18UPCSC2E02	-	Statistical Methods
18UPCSC2E03	-	Numerical Methods
18UPCSC2E04	-	Compiler Design

Elective Course -II

18UPCSC2E05	-	Computer Graphics
18UPCSC2E06	-	Wireless Network
18UPCSC2E07	-	Cyber Security
18UPCSC2E08	-	Web Services

Elective Course -III

18UPCSC2E09	-	Optimization Techniques
18UPCSC2E10	-	Soft Computing
18UPCSC2E11	-	Quantum Computing
18UPCSC2E12	-	Robotics

EXAMINATIONS - THEORY

EVALUATION OF **INTERNAL ASSESSMENT**

Test	:	10 (5+5 Marks, 5 marks from best one of Test 1 and Test 2, 5 marks from test 3 – mode examinations)
Seminar	:	05 Marks
Assignment	:	05 Marks
Attendance	:	05 Marks
Total	:	25 Marks

The Passing minimum shall be 50% out of 25 marks (13 marks)

EVALUATION OF **EXTERNAL EXAMINATIONS QUESTION PAPER PATTERN**

Time duration: 3 Hours Max. Marks: 75

PART- A: 20 x1 = 20

Answer all the questions

(Objective type four questions from each unit)

PART- B: 3 x 5 = 15

Answer any three questions out of five questions

(Questions must be of type analytical)

PART- C: 5x8 = 40

Answer all the questions

(Either or type for each unit)

The Passing minimum shall be 50% out of 75 marks (38 marks)

PRACTICAL / SOFTWARE DEVELOPMENT

EVALUATION OF **INTERNAL ASSESSMENT**

Test 1	:	15 Marks
Test 2	:	15 Marks
Record	:	10 Marks
Total	:	40 Marks

The Passing minimum shall be 50% out of 40 marks (20 Marks)

EVALUATION OF **EXTERNAL EXAMINATIONS**

Time duration: 3 Hours Max. Marks: 60

QUESTION PAPER PATTERN

1. One compulsory question from the given list of objectives : 30 Marks
2. One Either/OR type question from the given list of objectives : 30 Marks

Distribution of Marks

Problem Understanding	: 05 Marks
Program writing	: 10 Marks
Debugging	: 10 Marks
For Correct Results	: 05 Marks

Mini-Project Viva-Voce (joint): 60 Marks

DISSERTATION

Evaluation (External)	**: 50 Marks**
Viva-voce (joint)	**: 100 Marks**

10. REGULATIONS OF PROJECT WORK

a. Students should do their five months **[Dec to Apr]** Project work in Company / Institutions.
b. The Candidate should submit the filled in format as given in **Annexure-I** to the department for approval during the Ist Week of January in their Project semester.
c. Each internal guide shall have maximum of eight Students.
d. Periodically the project should be reviewed minimum three times by the advisory committee.
e. The Students should prepare three copies of the dissertation and submit the same to the college on **30th April** for the evaluation by examiners. After evaluation one copy is to be retained in the College Library and one copy is to be submitted to the University (Registrar) and the student can hold one copy.
f. A Sample format of the dissertation is enclosed in **Annexure-II**.
g. Format of the **Title page** and **certificate** are enclosed in **Annexure III.**
h. The Students should use OHP / Power Point Presentation during their Project Viva voce Examinations.

11. PASSING MINIMUM

The candidate shall be declared to have passed the examination if the candidate secures not less than 50% marks in the University examination in each paper / practical. However submission of a record notebook is a must.

For the project work and viva-voce a candidate should secure 50% of the marks for pass. The candidate should compulsorily attend viva-voce examination to secure pass in that paper.

12.CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in **First Class**. All other successful candidates shall be declared to have passed in **Second Class**. Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in **First Class with Distinction** provided they pass all the examinations prescribed for the course at the first appearance.

Candidates who pass all the examinations prescribed for the course in first instance and within a period of two academic years from the year of admission to the course only are eligible for **University Ranking.**

13.COMMENCEMENT OF THIS REGULATION

These regulations shall take effect from the academic year 2015-16, i.e., for students who are to be admitted to the first year of the course during the academic year 2015-16 and thereafter.

14.TRANSITORY PROVISION

Candidates who were admitted to the PG course of study before 2015-16 shall be permitted to appear for the examinations under those regulations for a period of three years i.e., up to and inclusive of the examination of April/May 2018. Thereafter, there will be permitted to appear for the examination only under the regulations then in force

ANNEXURE - I

PERIYAR UNIVERSITY

College Name :
Course :
Student Name :
Register Number :
Title of the Project :
Address of Organization / Institution :
Name of the External Guide :
Designation :
Place :
Date : Signature of External Guide
(with seal)

Name of the Internal Guide :
Qualification :
Teaching Experience :
Place :
Date : Signature of Internal Guide

Principal [Approved or not Approved]
[University Use]

ANNEXURE II

COLLEGE BONAFIDE CERTIFICATE

COMPANY ATTENDANCE CERTIFICATE

ACKNOWLEDGEMENT

CONTENTS

ANNEXURE III

Format of the title page

TITLE OF THE DISSERTATION

A Dissertation submitted in partial fulfillment of the requirements for the degree of **Master of Science in Computer Science** to the Periyar University, Salem - 11

By

STUDENT NAME

REG. NO.

College emblem

COLLEGE NAME (AFFILIATED TO PERIYAR UNIVERSITY)
PLACE with Pin Code
MONTH – YEAR

Format of the Certificate

COLLEGE NAME

(AFFILIATED TO PERIYAR UNIVERSITY)
PLACE with PIN CODE

College emblem

MONTH – YEAR

PROJECT WORK

TITLE OF THE DISSERTATION

Bonafide Work Done

by STUDENT NAME

REG.NO

A Dissertation submitted in partial Fulfillment of the requirements for the degree of **Master of Science in Computer Science** to the **Periyar University, Salem - 11.**

INTERNAL GUIDE HEAD OF THE DEPARTMENT

Submitted for the Viva-Voce Examination held on _____

Internal Examiner External Examiner

SEMESTER-I

Course-18UPCSC2C01 **Credits: 4**

DISCRETE MATHEMATICS FOR COMPUTING

(Theorems and Proofs are not expected)

Course objective

- To understand the applications of functions and relations
- To understand the basic concepts of mathematical logic and predicate
- calculus To understand the concept of method of induction
- To develop the skills in solving recurrence relations.

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

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.

Text Book

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

Unit 1:(2.1-2.11)
Unit 2:(1.3-1.7, 4.1-4.2, 5.1-5.5)
Unit 3:(6.1-6.5,3.1-3.6)
Unit 4:(8.1-8.6)
Unit 5:(10.1-10.5 and 10.8)

References

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:	Understand the Mathematical Logic. understand how the worst-case time complexity of an algorithm. Understand the applications of Graph Theory in Computer Science.	K1, K2	LO
CO2:	Apply basic concepts of set theory, arithmetic, logic, proof techniques, binary relations, graphs and trees	K3	IO
CO3:	Analyze the Recurrence Relations. Construct Lattice Applications	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows

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

S- Strong ; M-Medium; L-Low

Course-18UPCSC2C02 **Credits: 4**

DESIGN AND ANALYSIS OF ALGORITHMS

Course objective

- Apply the algorithms and design techniques to solve problems
- Analyze the complexities of various problems in different domains
- Analyze the performance of various algorithms.

Unit-I

Introduction – Notion of Algorithm - Fundamentals of algorithmic problem solving – Important problem types – Fundamentals of the analysis of algorithm efficiency – analysis frame work – Asymptotic Notations and Basic Efficiency Classes- Mathematical analysis of non-recursive Algorithms – Non-recursive solution to the Matrix Multiplication - Mathematical analysis of recursive algorithms – Recursive solution to the Tower of Hanoi Puzzle.

Unit-II

Divide and conquer Technique – Multiplication of large integers – Strassen's matrix multiplication – Closest pair and Convex Hull Problems - Greedy method – Prim's algorithm – Kruskal's algorithm – Dijkstra's algorithm.

Unit-III

Dynamic Programming - Computing a binomial coefficient – Warshall's and Floyd' Algorithm – Application of Warshall's Algorithm to the digraph – Floyd's Algorithm for the all pairs shortest paths Problem - The Knapsack problem and Memory function.

Unit-IV

Backtracking – N-Queens problem – Hamiltonian circuit problem – Subset sum problem – Branch and bound – Assignment problem – Knapsack problem – Traveling salesman problem.

Unit-V

P, NP and NP-complete problems – Approximation algorithms for NP-hard problems – Traveling salesman problem – Knapsack problem – Algorithm for solving Nonlinear Equations.

Text Book

1. Anany Levitin "Introduction to the Design and Analysis of Algorithms" Pearson Education 2009. (Chapters 1.1-1.3, 2.1, 2.2, 2.3, 2.4, 4.5, 4.6, 8.2, 8.4, 9.1-9.3, 11.3, 12.1,12.2, 12.3, 12.4)

Reference Books

1. Thomas H. Cormen, Charles E.Leiserson, Ronald L.Rivest, "Introduction to algorithms", Prentice Hall 1990.
2. S.K. Basu, "Design methods and Analysis of Algorithms", Prentice Hall, 2005.

Course Outcomes

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

CO1:	Understand the design issues associated with algorithms. understand how the worst-case time complexity of an algorithm	K1, K2	LO
CO2:	Classify the NP and NP-Hard problems. Demonstrate number of standard algorithms and problems involving graphs in computer science	K3	IO
CO3:	Compare the efficiency of algorithms using asymptotic complexity.	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows

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

S- Strong ; M-Medium; L-Low

Course-18UPCSC2C03 **Credits: 4**

ADVANCED OPERATING SYSTEMS

Course objective

- Understood the Concept of operating system principles and Evolution of OS
- Understood the Principles of Process and Threads, Deadlock, processor scheduling and Virtual memory management.
- Learnt case studies in different Operating Systems.

Unit I

Introduction to Operating Systems: What is an 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 and Threads:** Introduction – Process States – Process Management – Interrupts – Interprocess Communication. **Thread Concepts:** Introduction – Definition and Motivation for Threads – Thread States – Thread Operations – Threading Models – POSIX and Pthreads. **Case Study:** UNIX Processes – Java Multithreading Case Study.

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. **Case Study:** producer / Consumer Relationship in java.

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 V_s Non preemptive Scheduling – Priorities

– Scheduling Objectives – Scheduling Criteria – Scheduling Algorithms. **Case Study:** Real –Time Operating Systems.

Unit IV

Physical and Virtual Memory: Introduction – Memory Organization – Memory Management – Memory Hierarchy – Memory Management Strategies – Contiguous V_s 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. **Case Study:** IBM Mainframe Operating 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 Bahavior under Paging – Global V_s 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 – System Considerations-Caching and Buffering – Other Disk Performance Techniques – Redundant Array of Independent Disks (RAID). **Case Study:** Linux Page Replacement

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(3,4) (3.1 – 3.6, 4.1 – 4.8, 4.11)
   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): (6.1-6.4)
   Unit 3: Part 2(7):(7.1, 7.2, 7.4-7.10) Part 2(8): (8.1-8.9)
   Unit 4: Part 3(9): (9.1 – 9.10) Part 3(10): (10.1-10.7)
   Unit 5: Part 3(11): (11.1, 11.3-11.6, 11.8-11.13) Part 4 (12): (12.1-12.10)

Reference Books

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:	Understand the design issues associated with operating systems	K1, K2	LO
CO2:	Apply the master various process management concepts including scheduling, virtual memory, and deadlocks	K3	IO
CO3:	Analyze and design familiar with various types of operating systems including Unix	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows

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

S- Strong ; M-Medium; L-Low

Course-18UPCSC2C04 THEORY OF COMPUTATION Credits: 4

Course Objectives

- Able to understand how the abstract model of system is constructed from storage and combinational elements
- Explore the students to understand and analyze the dynamic behavior of discrete systems
- Able to examine how machines compute functions which is computable or decidable to solve problems

Unit – I

Basics of Automata theory and computation - history of automata- grammar-Chomsky hierarchy - use of automata - characteristics of automata - finite automata - graphical and tabular representation -transactional system -DFA and NFA – conversion of NFA to DFA
-Equivalence of DFA and NFA -Dead state -Finite automata with output-conversion of one machine to another-minimization of finite automata - Myhill-Nerode Theorem -Two way finite automata – applications-limitations.

Unit – II

Finite state machine - state equivalence and minimization of machine - incompletely specified machine - merger graph - merger table - finite memory and definite memory - information lossless machine - regular expression - operations on regular expression - identities of regular expression - Arden's theorem-construction of finite automata from regular expression.

Unit – III

Equivalence of two finite automata- Equivalence of two regular expression - construction of regular grammar from an RE - constructing FA from regular grammar - Closure properties of regular set- 'Grep' and regular expression-applications - context free grammar - derivation and parse tree - Ambiguity in context free grammar - left recursion and left factoring - simplification of context free grammar - linear grammar - normal form - closure properties –Applications.

Unit- IV

Push down automata - acceptance PDA - DPDA and NPDA - Construction of PDA from CFG - construction of CFG equivalent to PDA - Graphical notation for PDA - Turing Machine - transactional representation of turing machine – non deterministic turing – conversion of regular expression to turing machine.

Unit- V

Variations of turing machine - turing machine as an integer function - Universal turing machine - linear bounded automata - TM languages - unrestricted grammar - modified Chomsky hierarchy - Properties of recursive and recursively enumerable languages.

Text book

1. Shyamlendu Kandar, "Introduction to automata theory, formal languages and Computation" First Edition, Pearson Education, 2013.

Unit I - Chapters: 1.7-1.9, 2.1-2.2, 3.3-3.18

Unit II - Chapters: 4.3 - 4.10, 5.1-5.5

Unit III - Chapters: 5.7-5.10, 5.12, 5.14-5.15, 6.1-6.8, 6.13

Unit IV - Chapters: 7.1-7.6, 8.1-8.4

Unit V - Chapters: 9.1-9.4, 10.1-10.4

Reference Books:

1. K.V.N. Sunitha, "Formal Languages and Automata theory", Ist edition, Pearson Education, 2015
2. John E Hopcraft, "Introduction to Automata theory, Languages and Computation", 3rd edition, Pearson Education, 2008.
3. Rajesh Shukla, E V Prasad, "Formal Languages and Automata theory", 1st edition, Cengage learning India edition, 2012.

Course Outcomes

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

CO1:	Understand the key notions, such as algorithm, computability, decidability, and complexity through problem solving.	K1, K2	LO
CO2:	Apply the Theory of Computation, state and explain the relevance of the Church-Turing thesis.	K3	IO
CO3:	Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows

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

S- Strong ; M-Medium; L-Low

Course-18UPCSC2C05 **Credits: 4**

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.
- To introduce 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 – Bluetooth. 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. 4G and 5G Mobile Technologies - Features.
Chapter10.3.1 to 10.3.6 (Text Book 2- 6.1, 6.2, 6.4, 6.5, 6.6)

Text Book

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

References Books

1. Rifaat A. Dayen "Mobile Data & Wireless LAN Technologies", Prentice Hall, 197.
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 Frequencies for radio transmission, different Mobile Architecture, Wireless LAN, WAP Architecture, MANET and Routing protocols, 4G and 5G Mobile Technologies.	K1, K2	LO
CO2:	Apply the 4G and 5G wireless communication and networking principles	K3	IO
CO3:	Analyze and Create 4G – 5G mobile models	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows

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

S- Strong ; M-Medium; L-Low

Course-18UPCSC2C06 **Credits: 2**

WEB TECHNOLOGY LAB

Course objective

- To enable the students to design and develop the Web applications in open source environment.
- To make the students work web pages and style sheets
- effectively. To enable the students to design the web pages with java script.

1. Design Online Book Store using List and Frames
2. Design a Time Table using Table and Images
3. Embedding Video and Audio Files in HTML
4. Design Event Web Page using Style Sheet (Font/Text, Color and Border Properties)
5. Write an XML document to display your bio-data. Write an XSL style sheet and attach it tothe XML document. Validate the document using DTD or XSD.
6. Write an Ajax Program to get the User name suggestions in Registration Form
7. Web page using XML with JavaScript
8. Design Image Map using JavaScript
9. Registration Form Validation using JavaScript
10. Simple Game using Event handling in JavaScript
11. History of web pages using DOM
12. String Functions in PHP
13. Accessing the Student Examinations Result Database (MySQL) usingPHP
14. Develop a web application for Airline Reservation System using PHP and AJAX.
15. Online Shopping cart with Table operations (Insert, Select, Delete, Update) using PHP

Course outcome

On successful completion of the course, the students will

- understand modern protocols and systems used on Web (such as HTML, XSL, XML)
- select and apply markup languages for processing, identifying, and presenting of information in web pages.
- combine multiple web technologies to create advanced web components.
- write well-structured, easily maintained JavaScript and PHP code following accepted good practice.

Course-18UPCSC2C07 **Credits: 2**

ALGORITHMS LAB (LINUX)

- To enable the students to study the efficiency of different algorithms.
- To develop understanding of diverse algorithms by implementing them systematically.

1. Apply the divide and Conquer technique to arrange a set of numbers using merge sort method.
2. Perform Strassen's matrix multiplication using divide and conquer method.
3. Solve the knapsack problem using Dynamic Programming.
4. Construct a minimum spanning tree for Prim's algorithm using greedy method.
5. Perform Warshall's Algorithm using Dynamic Programming.
6. Solve Dijkstra's Algorithm using Greedy Technique.
7. Solve Subset Sum problem using Backtracking
8. Implement the 8-Queens Problem using backtracking.
9. Implement knapsack problem using backtracking.
10. Find the solution of traveling salesperson problem using branch and bound technique.

SEMESTER-II

Course-18UPCSC2C08 **Credits: 4**

WEB PROGRAMMING

Objective

- To enable the students to understand the basic concepts of .Net environment
- To make the students to develop strong internet programs, web applications and web services
- To learn about the technical concepts of .NET Environment

UNIT- I

Introduction to VB.NET – The .NET Framework –Object Oriented Programming and VB..NET–Encapsulation-Inheritance, Polymorphism – Data Types, Variables, and Operators – Arrays–Conditional Logic – Procedures – Dialog Boxes.

[Consider a sales and invoicing application that is used by a department store to calculate the total order value. Now, the store decides to offer a discount of 20% to all the customers buying more than 10 articles and a 10% discount to the remaining customers. Write a condition program for the above scenario]

UNIT - II

File IO and System Objects – Dictionary Objects – Error Handling – Name Spaces – Classes and Objects – Multithreading – Programming MSMQ.

[Create an airline application using MSMQ (Microsoft Message Queuing) technique to send the food information to the food provider which guarantees thefood delivery mechanisms]

UNIT - III

Data Access in .NET – DAO – OLEDB – Data Providers - ADO.NET – Dataset Object Model – Visual Studio.NET and ADO.NET – Visual Studio.NET and XML – Introduction to Windows Forms – Controls and Events – Specific Controls – Base Controls – Derived Controls –Display Controls – Dialogue Controls – Miscellaneous controls.

[Programmatically create a relationship between two Data Tables and then retrieve a collection of "child" Data Row objects in a related "order" table]

UNIT - IV

Web development – Languages and Technologies of the Web – Introduction to ASP.NET – Page Framework – Using Visual Studio.NET to build Web Forms – HTML Sever Controls – Web Controls.

[Turn your Windows 2000 computer into a server and work through a Web example presented in this Unit]

[Create an application which uses AdRotator control to rotate ads on a Web page. Let's say that you are building your own home page, and you wanted to display a picture on the first page from your last vacation. Wouldn't it be better to use the AdRotator control to provide an alternating list of images instead?]

UNIT - V

Validation Control – User Controls – Events – Cascading Style sheets – State Management – ASP.NET Applications – Tracing – Security.

[Sometimes you want to lock down applications and keep them off limits to all but certain selected individuals. Authentication and authorization of the users is a vital step in this process. Create a secure authentication and authorization model to protect your site from unwanted visitors]

TextBook

1. BillEvjen, Jason Beres,et al, “Visual Basic .NET Programming Bible”, Wiley India Publication,2002–Chapters 1-16,21-43.

ReferenceBooks

1. David Chappell, Understanding.NET,Pearsoneducation, 2002
2. David.S.Platt, IntroducingMicrosoft .Net ,PHI,2003.
3. GeorgeShepherd, Microsoft ASP.NET3.5 ,PHI, NewDelhi, 2008.
4. Steven Holzner, Visual Basic .NET Programming BlackBook, Dreamtech Press.
5. EvangelosPetroutsos, MasteringVisualBasic .NET ,BPBPublications.
6. Kathleen Kalata, usingASP.NET2.0-CengageLearning publications.

Course Outcomes

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

CO1:	Understand the structure of VB.NET and using main feature of IDE.	K1, K2	LO
CO2:	Apply the XML, HTML and CSS.	K3	IO
CO3:	Analyze and Create windows applications that uses VB.NET, ADO.NET and ASP .NET	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows

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

S- Strong ; M-Medium; L-Low

Course: 18UPCSC2C09 **Credits: 4**

ADVANCED JAVA PROGRAMMING

Course objective:

- To learn basics of Java programming concepts like Packages, Applets, Database Connectivity
- Enable the students to learn network programs in Java
- To provide knowledge on concepts needed for distributed and multi-tier applications

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.

Unit-II

Classes and Methods: Fundamentals- Declaring objects- Methods- Constructors-Garbage Collection- Overloading Methods. Recursion – Access Control- Nested and Inner Classes
- Command Line Arguments - Inheritance: Basics- Super Class- Method overriding- Abstract Class. Packages and Interfaces: Packages-Access Protection-Importing Packages- Interfaces.

Unit-III

Exception Handling: Fundamentals- types- Uncaught Exceptions- Try and Catch-throw- throws-finally-built-in exceptions. 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 - KeyEventClass- 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. JavaBeans: Advantages - Introspection – properties - Java Beans API. Servlets: Life Cycle-Simple Servlet- -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 Books

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., TMH, 2009.Chapter: 9, 11

Reference Books

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

Course Outcomes

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

CO1:	Understand the hierarchy of Java classes to provide a solution to a given set of requirements found in the Java API.	K1, K2	LO
CO2:	Apply the Client-Server Applications with Database Maintenance	K3	IO
CO3:	Analyze and develop a Graphical User Interface (GUI) with Applet and AWT. Design and implement server side programs using Servlets and JSP	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows

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

S- Strong ; M-Medium; L-Low

Course: 18UPCSC2C10 **Credits: 4**

DATA MINING

Objective:

- To understand and implement hidden knowledge extraction methods.
- Learn to apply different data mining techniques like Frequent pattern mining, Association rule mining, Dimensionality reduction, Classification and Cluster analysis.

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: 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

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

Reference books

1. Daniel T. Larose, Data Mining Methods and Models, ., Wiley Publication, 2006
2. David L. Olson DursunDelen , Advanced Data Mining Techniques, Springer-Verlag Berlin Heidelberg, 2008
3. Jiwei Han, MichelienKamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann Publishers an Imprint of Elsevier, 2006.
4. 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 the concepts of data mining. Know the working method of association rule Mining	K1, K2	LO
CO2:	Apply the supervised and unsupervised machine learning methods	K3	IO
CO3:	Analyze and Create the soft computing models	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows

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

S- Strong ; M-Medium; L-Low

Course: 18UPCSC2C11 **Credits: 2**

WEB PROGRAMMING-LAB

Objective:

- To enable the students to design and develop the Web applications in .NET Environment.
- To produce the students with software development skills.

VB.NET Programming

1. Write a VB.NET program to demonstrate abstract Polymorphism.
2. Create a VB.NET project for implementing switch statements.
3. Develop a VB.NET program for applying exceptional handling.
4. Construct an application for Billing System in Hotel.

ADO.NET Programming

5. Develop a Windows application with ADO.NET to perform Insert, Delete, Update and Select operations.
6. Build an ADO.NET program which displays the Employee information in the relevant fields from the database which already exists.

ASP.NET Programming

7. Build your own website using ASP.NET.
8. Code ASP.NET to create Online Registration Form.

Case Studies

9. Create a web application using ASP.NET that uses Validation Controls.
10. Build a secure ASP.NET Web Forms app with user registration, email confirmation, and password reset.

Course outcome:

On successful completion of the course, the students will

- Code programs and develop interfaces using
- VB.NET Efficiently implement OOPS concepts in
- program.
- Performing various operations in Windows application. Familiarizing with website creation and applications.

Course: 18UPCSC2C12 **Credits: 2**

ADVANCED JAVA LAB

Objective:

- To enable the students to implement different java packages.
- To develop the students with the skills to implement different java tools.

Use JAVA Programming Language to implement the following:

1. Concept of different types of inheritance.
2. Concept of Interface.
3. Concept of Package.
4. To handle mouse events.
5. To handle keyword events
6. To create applets incorporating the following Features:
   a. Create a color palette with matrix of buttons
   b. Set background and foreground of the control text area by selecting a color from color palette.
   c. In order to select Foreground or background use check box control as radio buttons
   d. To set background images
7. Use GridLayout to design a calculator and simulate the functions of simple calculator.
8. To Create Input output and Random files
9. To develop chat application with datagram sockets and datagram packets.
10. To invoke servlet from HTML forms.
11. To invoke servlet from Applets.
12. To invoke servlet from JSP.
13. Simple client/server application.
14. JDBC to interact with database.
15. To create multiple chat applications using TCP packets.

SEMESTER-III

Course Code: 18UPCSC2C13 **Credits: 4**

DIGITAL IMAGE PROCESSING

Course Objectives:

- To get familiar with the image acquisition process and color image processing models.
- To analyze the functionalities of spatial and frequency filters for image enhancement.
- To investigate the various edge detection models and their applications.
- To learn the concept of image compression and analyze the various compression techniques.
- To identify the requirements of various image segmentation methods and object recognition models for various real-time applications.

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. Object Recognition: Patterns and Classes – Recognition based on decision – Structural methods.

Text Book:

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:10.2.2,10.2.7,10.3,10.4,10.5,10.6,6.7,9.2-9.6,12.2-12.3)

2. A. K. Jain, Fundamentals of Image Processing, Second Ed., PHI, New Delhi, 2015. Unit – II (Chapters:7.2) Unit – III (Chapters:9.4)

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 ImageProcessing”, CRC Press, 2015.

Course Outcomes

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

CO1:	Understand the needs of image processing in various discipline like medical, engineering and etc.,	K1, K2	LO
CO2:	Evaluate the performance of various image enhancement models and edge detection models.	K3	IO
CO3:	Apply different image compression schemes, segmentation models, feature extraction and pattern classification models.	K4, K5, K6	HO

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO11	PO12
CO1	L	-	-	L	L	-	-	L	-	-	-	-
CO2	M	M	M	M	M	-	-	-	M	M	M	-
CO3	S	S	S	S	S	S	-	-	S	-	S	S

S- Strong ; M-Medium ; L-Low

Course Code: 18UPCSC2C14 **Credits: 4**

INTERNET OF THINGS

Course Objectives:

- ✓ To get familiar with the evolution of IOT with its design principles
- ✓ To outline the functionalities and protocols of internet communication
- ✓ To analyze the hardware and software components needed to construct IOT applications
- ✓ To identify the appropriate protocol for API construction and writing embedded code
- ✓ To realize various business models and ethics in Internet of Things

UNIT – I

The Internet of Things: An Overview –The Internet of Things – The Technology of the Internet of Things - Enchanted objects. **Design Principles for Connected Devices**: Calm and Ambient Technology – metaphor – Privacy – Web thinking for connected Devices.

UNIT – II

Internet Principles: Internet Communications overview – IP – TCP – TCP/IP – UDP. IP Addresses: DNS – Static and Dynamic IP Address Assignment – MAC Addresses – TCP and UDP Ports – Application Layer Protocols. **Thinking about Prototyping:** Sketching – Familiarity – Prototypes and Production – Open Source versus Closed Source.

UNIT – III

Prototyping Embedded Devices: Electronics - Embedded Computing Basics – Arduino - Raspberry Pi - Beagle Bone Black - Electric Imp. **Prototyping the Physical Design:** Non digital Methods - Laser Cutting - 3D printing - CNC Milling - Repurposing/Recycling.

UNIT – IV

Prototyping Online Components: Getting started with an API - Writing a New API - Real-Time Reactions - Other Protocols. **Techniques for Writing Embedded Code:** Memory Management - Performance and Battery Life – Libraries - Debugging.

UNIT – V

Business Models: History of Business Models – Model – Internet of Starting up – Lean Startups. **Moving to Manufacture:** Designing Kits - Designing Printed

circuit boards – Certification – Costs - Scaling Up Software. **Ethics:** Privacy – Control – Environment – Solutions.

Text Book:

1. Adrian McEwen and Hakim Cassimally, **"Designing the Internet of Things"**, Wiley, 2014. (Chapters : 1, 2, 3, 4, 5, 6, 7, 9, 10, 11)

Reference Books:

1. Ovidiu Vermesan and Peter Friess, "Internet of Things – From Research and Innovation to Market Deployement" , River Publishers, 2014.
2. Peter Waher, "Learning Internet of Things" ,Packt Publishing, 2015.
3. Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black",McGraw Hill, 2015.

Course Outcomes

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

CO1:	Explain the Evolution of Internet of Things. Describe the principles for developing an IOT application	K1, K2	LO
CO2:	Develop an IOT API using various protocols and techniques. Design kits and follow ethics to secure the IOT applications	K3	IO
CO3:	Compare and contrast Arduino, Raspberry Pi and Beagle Bone Black. Analyze various protocols to build the business models	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows

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

S- Strong ; M-Medium; L-Low

Course-18UPCSC2C15 **Credits: 4**

MACHINE LEARNING

Course Objectives:

- To understand the relationship between the target and one or more predictors
- To implement regression for developing a statistical model to predict the target
- To understand the basic concept of classification and construct a binary classification model
- To outline the various models used for developing classification models
- To identify the optimization problem to be solved by the evolutionary or heuristic search algorithm

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 -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.Ch:1,2,4,10,11,19,22,23,29

Reference Books:

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 concept of how the machine learns using huge amount of data. Identify the model based on the predictor and target variable. Recognize the parameters to be optimized in machine learning task.	K1, K2	LO
CO2:	Apply different machine learning algorithms to model the relationship between independent and dependent variables. Employ genetic algorithm to optimize the parameters used in machine learning algorithms.	K3	IO

CO3:	Analyze the problem and develop the optimal model based on data in real time. Evaluate and compare the model performances using various evaluation measures.	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	L	L	-	L	L	-	-	-	L	L	L	-
CO 2	M	M	M	M	M	-	-	M	M	-	M	M
CO 3	-	S	-	S	S	-	-	-	S	S	S	S

S- Strong ; M-Medium; L-Low

Course-18UPCSC2C16 **Credits: 4**

CRYPTOGRAPHY AND NETWORK SECURITY

Objectives:

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
- To know about the malicious software & firewalls.

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:	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities Understand various Security practices and System security standards	K1, K2	LO
CO2:	Apply the different cryptographic operations of symmetric cryptographic algorithms machine learning algorithms. Apply the different cryptographic operations of public key cryptography. Apply t h e various Authentication schemes to simulate different applications.	K3	IO
CO3:	Analyze the problem and develop the optimal model based on data in real time. Evaluate and compare the model performances using various evaluation measures.	K4, K5, K6	HO

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

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO1	**PO2**	**PO 3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO1 0**	**PO11**	**PO12**
CO1	L	L	-	L	L	-	-	-	L	L	L	-
CO2	M	M	M	M	M	-	-	M	M	-	M	M
CO3	-	S	-	S	S	-	-	-	S	S	S	S

S- Strong ; M-Medium; L-Low

Course-18UPCSC2C17 **Credits: 2**

IMAGE PROCESSING LAB USING PYTHON

Course Objectives

- ✓ To understand the concepts of Image Processing.
- ✓ To develop the programming skills in Python.

1. Write a Python program using different Morphological Operations
2. Write a Python program using different Edge Detection Methods
3. Write a Python program using the concepts of Histogram Equalization to improve the contrast of images
4. Write a Python program to find objects in an image using Template Matching concepts
5. Write a Python program using Marker-based Image Segmentation using Watershed algorithm
6. Write a Python program using GrabCut algorithm to extract foreground in images Interactive Foreground Extraction
7. Write a Python program for implementing the concepts of Harris Corner Detection
8. Write a Python program for implementing the string match features in one image with others using the Brute-Force matcher method.
9. Write a Python program for implementing the hand-written data OCR with SVM algorithm
10. Write a Python program for implementing the data clusteringconcept using Kmeans algorithm

Reference Website

1. https://opencv-pythontutroals.readthedocs.io/en/latest/py_tutorials/py_gui/py_image_display/ py_image_display.html#display-image.

Course Outcomes:

On completion of the course students will be expected to:

- To learn the key aspects of image processing.
- Implement image processing through applications.
- Gain research knowledge to develop applications using image processing techniques.
- To gain knowledge in machine learning through the Python language.

Course-18UPCSC2C18 **Credits: 2**

MINI PROJECT USING MACHINE LEARNING TECHNIQUES

Objective:-

- Make use of Data sets in implementing the machine learning
- algorithms Implement the machine learning concepts for various
- applications

  To apply mathematical aggregation operators and Statistical operations in "R" for various problems

In this course, students are expected to implement Machine Learning algorithms for various data sets taken from UCI repository or other benchmark datasets or real data sets.

Outcomes:-

- To learn the key aspects of Machine Learning
- Gain research Knowledge to develop applications using hybrid
- systems To gain knowledge in machine learning through the R language.

Course-18UPCSC2C19 **Credits:2**

SOFT SKILL DEVELOPMENT-LAB

Course Objectives:

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

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

Course Outcomes:

On completion of the course students will be expected to:

- To Plan, organise, and present technical articles in the frame of the scientific method
- To Develop Business communication skills in
- corporateenvironment Apply their interpersonal skills in technical, professional and socialcontexts

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., CUP2014
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

SEMESTER-

IV OPTION-I

Course-18UPCSC2C20 **Credits: 20**

Dissertation and Viva Voce (Industry)

The students are expected to do their dissertation for one full semester by attaching themselves with a well reputed organization/research institution. The report should be submitted as per the format provided in Annexure II.

SEMESTER-IV OPTION-II

Course-18UPCSC2C21 **Credits: 4**

BIG DATA ANALYTICS

Course Objectives:

- To get familiar with the Concepts, Terminology, Characteristics and Life Cycle of Big Data Analytics
- To Analyze the Benefits and Challenges of core components of Hadoop and apply File System Shell Commands for HDFS.
- To Select Key and Value Types for MapReduce Jobs and analyze the Hadoop Distributed File System
- To Examine the Apache Hive and HBase Environment for Create Table, Insert Data and Alter Data in Apache Server
- To Develop and Test Pig Latin Scripts and Writing Evaluation and Filter Functions

UNIT – I

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

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

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

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

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 Book

1. Alan Gates,"Programming Pig", Oreilly Publication, 2011.
2. DeepakVohra,"PracticalHadoopEcosystem:ADefinitiveGuidetoHadoop-Related Frameworksand Tools",Apress, 2016.
3. ThomasErl,WajidKhattak,PaulBuhler,"BigDataFundamentalsConcepts, Drivers & Techniques", ServiceTech Press,2015.

Reference books

1.NoreenBurlingame,"ThelittlebookonBigData",NewStreetpublishers ,2012. 2.Anil Maheshwari, " Data Analytics", McGraw Hill Education, 2017.

Course Outcomes

CO1:	Recognize the Concepts, Terminology, Characteristics of Big Data Analytics and understand the Core components of Hadoop and Hadoop Distributed File System	K1,K2	LO
CO2:	Evaluate Filter functions, Writing and Loading Store Function using Pig Latin Scripts	K3	IO
CO4:	Apply Query Statements for Create Table, Insert Data and Alter Data in the Apache Hive and HBase Environment	K4,K5,K6	HO

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Course-18UPCSC2C22 **Credits: 2**

BIG DATA ANALYTICS– LAB

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
   - Input and Output Operations
   - Relational Operations
7. Implement the following using Pig Latin
   - User Defined Functions
   - Advanced Relational Operations
8. Implement the following using Hive commands
   - Handling the Database
   - Creating and Manipulating Table
9. Implement the following using Hbase commands
   - Creation of Tables
   - Table Manipulation
10. Create a Hive External Table stored by HBase in Hive

Course-18UPCSC2C23 **Credits: 11**

Dissertation and Viva Voce (Industry)

The students are expected to do their dissertation for one full semester by attaching themselves with a well reputed organization/research institution. The report should be submitted as per the format provided in Annexure II.

ELECTIVE – I

Course-18UPCSC2E01 **Credits: 3**

OPERATIONS RESEARCH

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): Mathematical Formulation of Linear Programming Problem- Graphical Solution of LPP - canonical and standard forms of linear programming problem.

Unit – II

Algebraic Solution: Simplex Algorithm – Basic Feasible Solution - Solving Linear Programming Problems with slack variable-Big M Method- Solving Linear Programming Problems with surplus variable.

Unit – III

Transportation Model: North West corner Method, Least cost method, and Vogel's Approximation Method. 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 Policy.

Unit – V

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

Text Book

1. P. K. Gupta and Man Mohan, Problems in Operations Research, Sultan Chand and Sons, New Delhi, 2014

Reference Books:

1. Hamdy A. Taha, Operations Research: An Introduction, Pearson, 2010

Course Outcomes

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

CO1:	Understand the concept of optimization.	K1, K2	LO
CO2:	Formulate and Apply the Mathematical Model on various applications	K3	IO
CO3:	Analyze and Create the Linear Programming Problems using different models	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO11	PO12
CO1	L	L	L	L	L	-	-	-	-	-	-	-
CO2	M	M	M	M	M	-	-	M	-	-	-	-
CO3	-	-	-	-	-	-	-	-	S	S	S	S

S- Strong ; M-Medium ; L-Low

Course-18UPCSC2E02 **Credits: 3**

STATISTICAL METHODS

Course Objectives:

- 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 (x^2) 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 x^2Distributions- 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.

Reference:

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.

Course Outcomes

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

CO1:	Understand the concept of statistics	K1, K2	LO
CO2:	Formulate and Apply the Statistical Models on various applications	K3	IO
CO3:	Analyze and Create the different Sampling Models	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO11	PO12
CO1	L	L	L	L	L	-	-	L	-	-	-	-
CO2	M	M	M	M	M	-	-	M	-	-	-	-
CO3	-	-	-	-	-	S	-	-	S	S	S	S

S- Strong ; M-Medium ; L-Low

Course: 18UPCSC2E03 **Credits: 3**

NUMERICAL METHODS

Objective **(Theorems and Proofs are not expected)**

- To under standard the concept of approximation
- To study various Numerical Method based algorithms

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 – method 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: Gauss elimination Method- Gauss Jordan Method-Crout's Method. Iterative Methods: Gauss Jacobi's Method-Gauss Seidal method-Relaxation Method.

Unit –IV

inite Differences: Newton's forward interpolation formula-Newton's backward interpolation formula. Central Differences – Gauss's Forward Formula – Gauss's Backward Formula Sirling's Formula-Bessel's Formula

Unit-V

Interpolation with unequal Intervals: Divided Differences – Inverse Interpolation – Numerical Differentiation – Numerical integration

Text Book:

1. A. Singaravelu, Numerical Methods, Meenakshi

Publications, Chennai, 1999. Reference:

1. S.S.Sastry, "Introductory methods of numerical analysis", PHI, New Delhi1982.
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:	Understand the concept of Approximation	K1, K2	LO
CO2:	Formulate and Apply the Numerical methods	K3	IO
CO3:	Analyze and Create the different Numerical Methods.	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO11	PO12
CO1	L	L	L	L	L	-	-	L	-	-	-	-
CO2	M	M	M	M	M	-	-	M	-	-	-	-
CO3	-	-	-	-	-	S	-	-	S	S	S	S

S- Strong ; M-Medium ; L-Low

Course-18UPCSC2E04 **Credits: 3**

COMPILER DESIGN

Course Objectives:

- To get familiar with the structure of the compilation process and analyze the role of lexical analysis phase.
- To analyze the role of the parser and the parsing methods, for writing rules for a grammar.
- To Examine the Inherited and Synthesized attributes and understand the basic concepts of Dependency graphs, Ordering the evaluation of attributes, and Syntax Directed translations schemes
- To Translate given input to intermediate code using Three Address code and apply Switch Statements and Procedure calls during the conversion of source code to intermediate code
- To Identify various types of optimizations on intermediate code and generate assembly code

UNIT – I

LEXICAL ANALYSIS - Language Processors, The Structure of a Compiler, Parameter passing mechanism– Symbol table-The role of the lexical analyzer- Input buffering- Specification of tokens -Recognition of tokens– Finite automata- Regular expression to automata

UNIT–II

SYNTAX ANALYSIS - The role of the parser -Context-free grammars- Writing a grammar–Top down Parsing- Bottom-up Parsing- LR parsers- LALR parsers.

UNIT–III

SEMANTIC ANALYSIS - Inherited and Synthesized attributes–Dependency graphs– Ordering the evaluation of attributes– S-attributed definitions– L-attributed definitions– Applications of Syntax Directed translation– Syntax Directed translations schemes- Storage organization– Stack allocation of space.

UNIT–IV

INTERMEDIATE CODE GENERATION - Variants of Syntax trees–Three Address code– Types and Declarations- Translation of Expressions– Type checking-Control flow- Back patching- Switch Statements- Procedure calls.

UNIT–V

CODE GENERATION AND CODE OPTIMIZATION – Issues in the design of a code generator–The target language–Address in the Target Code– Basic Block and Flow graphs– Optimization of Basic Blocks – A simple code generator– Peephole Optimization

Text Book:

1. Alfred V. Aho, MonicaS.Lam, Ravi Sethi and Jeffrey D. Ullman, "Compilers- Principles, Techniques and Tools", Second Edition, Pearson Education Asia, 2009.

Unit-I:(Chapters:1.1,1.2,1.6.6,2.7,3.1,3.2,3.3,3.4,3.6,3.7)
Unit– II:(Chapters:4.1.1,4.2,4.3,4.4,4.5,4.5,4.7)
Unit-III:
(Chapters:5.1.1,5.2.1,5.2.2,5.2.3,5.2.4,5.3,5.4,7.1,
7.2)
Unit– IV:(Chapters:6.1to
6.9) Unit–
V:(Chapters:8.1to8.7)

Reference books

1. A.V. Aho, Ravi Sethi, J.D. Ullman, Compilers- Principles, Techniques and Tools, Addison-Wesley, 2003.
2. Fischer Leblanc, Crafting Compiler, Benjamin Cummings, Menlo Park, 1988.
3. Kennath C. Louden, Compiler Construction Principles and Practice, Vikas publishing House, 2004.
4. AllenI. Holub, Compiler Design in C, Prentice Hall of India, 2001.
5. S.GodfreyWinster, S.Aruna Devi, R.Sujatha,"Compiler Design", yesdee Publishers, Third Reprint2019

Course Outcomes

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

CO1:	Understand the structure of the compilation Process and should be distinguish what happens at each and every phase of a compiler	K1, K2	LO

CO2:	Evaluate the Context-free grammars and parsing methods for removing useless productions, symbols and removing epsilon productions	K3	IO
CO3:	Apply code optimization techniques to reduce number of instructions in a program.	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows.

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

S- Strong ; M-Medium ; L-Low

ELECTIVE – II

Course: 18UPCSC2E05 **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:

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

Course Outcomes

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

CO1:	Understand the fundamentals of Graphics system, display devices and techniques and pixel transformations. Understand various colouring models and animation practices..	K1, K2	LO
CO2:	Apply the different graphical operations of drawing algorithms. Apply the different transformation concepts in 2D and 3D views. Apply the various surface detection methods to simulate the user visibility in different applications.	K3	IO
CO3:	Analyze the Create 2D and 3D Colour models	K4, K5, K6	HO

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

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO11	PO1 2
CO1	L	L	L	L	L	-	L	-	-	-	-	-
CO2	M	-	M	M	M	-	-	-	M	-	-	M
CO3	S	-	-	-	-	-	-	-	S	-	S	S

S- Strong ; M-Medium; L-Low

Course: 18UPCSC2E06 **Credits: 3**

WIRELESS NETWORK

Course Objective:

- ☐ To understand about Wireless Networks - Protocol Stack and Standards.
- ☐ To Study about Fundamentals of Mobile Network Layer and Mobile Ad-Hoc Network, and its Protocols and Applications.
- ☐ To Study about Fundamentals of Mobile Transport Layer and Classical TCP Improvements
- ☐ To understand about Evolution of 3G Networks - its Architecture and Applications and to outline the Design and implement Wireless Protocols
- ☐ To understand about Evolution of 4G Networks - its Architecture and Applications and to outline the Design and implement Wireless Protocols

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 – HIPERLAN: 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.
2. Vijay Garg - "Wireless Communications And Networking" - First Edition - Elsevier 2014.

Course Outcomes

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

S. No.	Course Outcomes	Knowledge Level	
CO1	Understanding the concept of Wireless Networks - Protocol Stack and Standards.	**K1,K2**	LO
CO2	Evolution of 3G Networks - its Architecture and Applications and to outline the Design and implement Wireless Protocols. Evolution of 4G Networks - its Architecture and Applications and to outline the Design and implement Wireless Protocols	**K3**	IO
CO3	Analyze the fundamentals of Mobile Network Layer and Mobile Ad-Hoc Network, and its Protocols and Applications. Analyze the fundamentals of Mobile Transport Layer and Classical TCP Improvements	**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	-	-	L	L	L	L	L	L	L	L	-	L
CO2	-	-	-	-	-	M	M	M	-	-	-	-
CO3	S	S	S	S	S	-	S	-	-	-	-	-

S- Strong; M-Medium; L-Low

Course: 18UPCSC2E07 **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 crime prevention: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, jimsteele, jonR.hansen, captain Benjamin R.jean Thomas Ralph, "Cyber crime investigations" bridging the gaps between security professionals, law enforcement, and prosecutors2007.(Chapter: 4, 5, 6, 7, 8, 9, 10)

Course Outcomes

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

CO1:	Understand the fundamentals of Cyber security, Cyber Crime, threats and vulnerabilities. Understand various digital forensic and analyzing data for preventing cyber crime.	K1, K2	LO
CO2:	Apply the different operational tips for Social networks and browsers. Apply the different Investigation roles to identify the cyber crime.	K3	IO
CO3:	Analyze and Create the Cyber Crime Models	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO1	PO2	PO 3	PO 4	PO5	PO 6	PO7	PO 8	PO 9	PO1 0	PO11	PO12
CO1	L	-	-	L	L	L	-	L	-	-	-	-
CO2	-	M	M	M	M	M	-	-	-	M	-	-
CO3	-	S	-	-	-	-	-	S	S	S	S	S

Course: 18UPCSC2E08 **Credits: 3**

WEB SERVICES

Course Objectives:

- To learn the aspects of Web Services and Service Oriented Architecture.
- To identify the technical forces driving adoption of web services, service oriented architecture and cloud computing.
- To understand the working principle of web services, service oriented architecture and cloud computing.
- To gain knowledge of the Amazon web services philosophy and its functional components.
- To examine the different levels of AWS security and Relational database services.

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", TataMcGraw-Hill Education, Third Edition, 2012.

2. M. Papazoglou, "Web Services: Principles and Technology", Pearson PrenticeHall, 2008.

3. Letha Hughes Etzkorn, "Introduction to Middleware: Web Services, ObjectComponents, and Cloud Computing", Chapman and Hall/CRC; 1 edition, 2017.

4. Michael J. Kavis, "Architecting the Cloud: Design Decisions for CloudComputing 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:	Understand the aspects of web services, service oriented architecture and cloud computing.	K1, K2	LO
CO2:	Examine the service oriented architecture relationship with web services and cloud environment.	K3	IO
CO3:	Apply different levels of security on amazon web services, cloud environment and AWS Networking.	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO1	PO2	PO 3	PO 4	PO5	PO 6	PO7	PO 8	PO 9	PO1 0	PO11	PO12
CO1	L	-	-	L	L	-	-	-	-	-	-	-
CO2	-	M	M	M	M	M	-	M	M	-	M	M
CO3	-	S	S	S	S	S	-	S	S	S	S	S

S- Strong ; M-Medium ; L-Low

ELECTIVE – III

Course: 18UPCSC2E09 **Credits: 3**

OPTIMIZATION TECHNIQUES

Course Objectives:

- To learn mathematical model.
- Design and implement mathematical computational problems.

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.

Textbooks:

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.

References:

1. D.Shanthi, N.UmaMaheswari, S.Jeyanthi, "Theory of Computation", Yesdee Publishing.
2. JohnW.Chinneck, "Feasibility and Infeasibility in Optimization-Algorithms and Computational Methods ", Springer, 2015.

Course Outcomes

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

CO1:	Understand the mathematical model	K1, K2	LO
CO2:	Apply the Formulations and graphical solution of (2 variables) canonical and standard terms of linear programming problem. Apply the dual problem to primal, primal to dual problem, duality simplex method, Revised simplex method. Apply the North West corner Method, Least cost method, and vogel's approximation method. Apply the Replacement policy for equipment that deteriorate gradually, Replacement of item that fail suddenly. Apply the individual and group replacement, Problems in mortality and staffing.	K3	IO
CO3:	Evaluate PERT/CPM Networks, Fulkerson's Rule, Measure of Activity. Evaluate the PERT Computation, CPM Computation, Resource Scheduling.	K4, K5, K6	HO

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

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO11	PO1 2
CO1	-	L	-	L	L	-	L	L	L	-	L	-
CO2	M	-	M	M	M	-	-	-	M	-	M	M
CO3	S	S	S	S	-	S	-	-	S	-	S	S

S- Strong ; M-Medium; L-Low

Course: 18UPCSC2E10 **Credits: 3**

SOFT COMPUTING

Course Objectives:

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. Saroj Kaushik, 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:	Understand perceptrons and Associative Memory Networks. Apply neural networks to pattern classification. Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic. 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	K1, K2	LO

	techniques.		
	To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations.		
CO2:	Apply fuzzy logic and reasoning to handle uncertainty. Effectively use existing software tools to solve real problems using a soft computing approach.	K3	IO
CO3:	Evaluate and compare solutions by various soft computing approaches for a given problem. Analyze and integrate various soft computing techniques in order to solve problems effectively and efficiently. Analyze various neural network architectures.	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO1 0**	**PO11**	**PO1 2**
CO1	-	L	-	L	L	-	L	-	L	-	L	-
CO2	M	-	M	M	M	-	-	-	M	-	-	M
CO3	S	S	S	S	-	-	-	-	S	-	S	S

S- Strong ; M-Medium; L-Low

Course: 18UPCSC2E11 **Credits: 3**

QUANTUM COMPUTING

Course Objective:

This course provideS opportunities to students through exposition of quantum computing and underlying concepts of quantum physics, explaining the entire relevant mathematics concept

Unit–I: Introduction: Overview of quantum computing–Single qubit quantum systems– The quantum mechanics of photon polarization-Single quantum bits-Single qubit measurements-A quantum key distribution protocol–The state space of single qubit system-The multiple qubit system-Quantum state spaces-Entangled state-Basic of multiple qubit system-Quantum key distribution using entangled states.

Unit-II: Measurement of Multiple Qubit States: Dirac notation for linear transformation-Projection operators for measurements Hermition operator-The measurement postulate-EPR Paradox and Bells Theorem Set-Up for Bell's Theorem-Bell inequality-Unitary transformations-The impossible Transformations-The No-Cloning principle-Some Simple quantum Gates-The Pauli transformation- The Hadamard transformations-Multiple qubit transformation from single qubit transformation- Applications of simple Gates-Realizing Unitary transformations as quantum circuits-A universally approximating set of Gates.

Unit-III: Quantum versions of Classical Computations: From reversible computations to quantum computations-Reversibleimplementationsofclassicalcircuits-Alanguagefor quantum implementation-Some examples for arithmetic operations-Quantum algorithms-Notations of complexity-A simple quantum algorithm-Quantum subroutines-Few simple quantum algorithms-Machine models and complexity classes.

Unit-IV: Shor 'SandGrover'S Algorithms :Shor's factoring algorithm-An example-The efficiency of Shor's algorithm Generalizations-Grover's algorithm and generalizations- Amplitude amplification Optimality of Grover's algorithm-De-randomization of Grover's algorithm and amplitude amplification.

Unit-V: Quantum computational Complexity an Error correction: Computational complexity–black-box model–lower bounds for searching–general black-box lower bounds–polynomialmethod–blocksensitivity– adversarymethods–classical error correction– classical three-bit code–fault tolerance–quantum error correction– three- and nine-qubit quantum codes– fault tolerant quantum computation.

TEXT BOOKS:

1. Eleanor G. Rieffel, WolfgangH. Polak, "Quantum Computing: A Gentle Introduction" Kindle Edition, 2011.
2. P. Kaye, R.Laflamme, and M.Mosca,"An introduction to Quantum Computing", Oxford University Press, 1999.https://www.iro.umontreal.ca/~hahn/IFT3545/GTWA.pdf

REFERENCES:

1. Lecture Videos:https://www.eecis.udel.edu/~saunders/courses/87903s/quantumComputers.ppt

Course Outcomes

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

CO1:	Remember the basics of algorithms	K2	LO
CO2:	Demonstrate to produce a new view of computing and information.	K3	IO
CO3:	Evaluate the how quantum information processing explore	K4,K5,K6	HO

Mapping with Programme Outcomes

The mapping of course outcomes with program me outcomes is tabulated as follows.

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

S- Strong; M-Medium; L-Low

Course: 18UPCSC2E12 **Credits: 3**

ROBOTICS

Course Objectives:

- To introduce the basic concepts of Robot with its processing layout
- To analyze the operation time and computation techniques of various drives and sensors
- To get familiar with the operating system and simulators for modeling a real phenomenon
- To identify the hardware components and design ChefBot Robot
- To integrate different hardware components and interfacing between these components

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.

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.

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.

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.

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 control GUI - Installing and working with rqt in Ubuntu 16.04 LT

Text Book:

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 approach", Prentice Hall of India, New Delhi, 1994.
3. Mc Kerrow P.J. "Introduction to Robotics", Addison Wesley, USA, 1991.

4. Issac Asimov "Robot", Ballantine Books, New York, 1986.
5. 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:	Recognize the basis of Robotics and its layout. Understand the fundamentals of Sensors, Drivers, Hardware and Operating Systems to model a Robot and learn various tools to build and simulate the robot.	K1, K2	LO
CO2:	Apply different techniques for building basic Robot model using various operating systems and simulators, employ various authentication techniques to simulate different applications and interface the hardware components to Robot Controller.	K3	IO
CO3:	Analyze the features of a Robot to design and asses its performance.	K4, K5, K6	HO

The mapping of course outcomes with programme outcomes is tabulated as follows.

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO11	PO1 2
CO1	-	L	-	L	L	-	L	-	L	-	L	-
CO2	M	-	M	M	M	-	-	-	M	-	-	M
CO3	S	S	S	S	-	-	-	-	S	-	S	S

S- Strong ; M-Medium; L-Low