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 2019-2020 and thereafter)

M. Sc. COMPUTER SCIENCE

OBE REGULATIONS AND SYLLABUS

(With effect from the academic year 2019-2020 onwards)

1. Preamble

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

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 an 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.

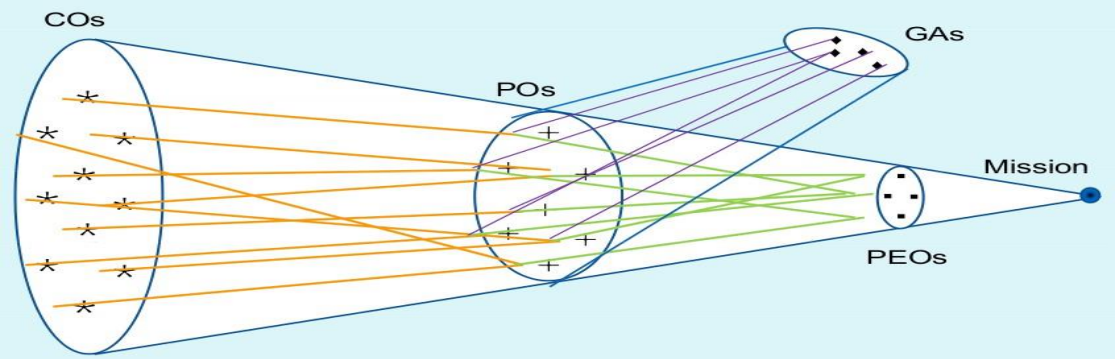
- **Analytical level (K4)**
  - Be able to separate information related to a procedure or technique into its constituent parts for better understanding and can distinguish between facts and inferences.
- **Evaluation capability level (K5)**
  - Be able to make judgments based on criteria and standards. 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.

4. 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)

5. 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, correctly 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												

6. 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.

7. 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.

8. 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	10	40	1000	40
Elective Courses	5	20	500	20
Supportive Courses	1	3	100	3
Core – Practical	5	5	500	10
Mini-Project	1	4	100	2
Core – Theory cum Practical	-	-	-	-
Project (Option – I) – Sem-IV	1	-	200	17
Project (Option – II) – Sem – IV	1	-	200	9
Core Course (Option – II) – Sem – IV	1	4	100	4
Elective Courses (Option – II) – Sem – IV	1	4	100	4
Online Courses	3	3	-	-
Total			2600	92
Part B (Self-Learning Credit Courses)				
Elective Foundation Courses				
Total				

Core Courses (CC):

Course Code	Name of the Course	Category	No. of Hours / Week			Credits
			L	T	P	
THEORY						
19UPCSC2C01	Design and Analysis of Algorithms Computing	CC	3	1	-	4
19UPCSC2C02	Advanced Web Technology	CC	3	1	-	4
19UPCSC2C03	Advanced Data Base Management Systems	CC	3	1	-	4
19UPCSC2C04	Compiler Design	CC	3	1	-	4
19UPCSC2C07	Distributed Operating System	CC	3	1	-	4
19UPCSC2C08	Advanced Java Programming	CC	3	1	-	4
19UPCSC2C09	Cryptography and Network Security	CC	3	1	-	4
19UPCSC2C11	Digital Image Processing	CC	3	1	-	4
19UPCSC2C12	Internet of Things	CC	3	1	-	4
19UPCSC2C13	Machine Learning	CC	3	1	-	4

Elective Courses (EC):

Course Code	Name of the Course	Category	No. of Hours / Week			Credits
			L	T	P	
THEORY						
19UPCSC2E01	Advanced Computer Network	EC	4	-	-	4
19UPCSC2E02	Cloud Computing					
19UPCSC2E03	Web Services					
19UPCSC2E04	Object Oriented System Development					
19UPCSC2E05	Mobile Computing					
19UPCSC2E06	Wireless Networks					
19UPCSC2E07	Theory of Computation					
19UPCSC2E08	Optimization Techniques					
19UPCSC2E09	Embedded Systems					
19UPCSC2E10	WAP and XML					
19UPCSC2E11	Statistical Computing					
19UPCSC2E12	Software Project Management					
19UPCSC2E13	Dot Net Programming					
19UPCSC2E14	Data Science and Big Data Analytics					
19UPCSC2E15	Soft Computing					
19UPCSC2E16	Data Mining					
19UPCSC2E17	Discrete Mathematics for Computing					
19UPCSC2E18	Operations Research					
19UPCSC2E19	Cyber Security					

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	
19UPCSC2C05	Algorithms-Lab	CP	-	-	4	2
19UPCSC2C06	Advanced Web Technology-Lab	CP	-	-	4	2
19UPCSC2C10	Advanced Java –Lab	CP	-	-	4	2
19UPCSC2C14	Image Processing – Lab	CP	-	-	4	2
19UPCSC2C15	Mini Project (Machine Learning)	CP	-	-	4	2
19UPCSC2C17	Soft Skill Development - Lab	CP	-	-	2	2

Theory cum Practical (TP):

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

Online Courses (OC):

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

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

Course	L T P	No. Hours / Week	Number of Credits
Semester-I			
Core Course-19UPCSC2C01 Design and Analysis of Algorithm	3+1+0	4	4
Core Course-19UPCSC2C02 Advanced Web Technology	3+1+0	4	4
Core Course-19UPCSC2C03 Advanced Data Base Management Systems	3+1+0	4	4
Core Course-19UPCSC2C04 Compiler Design	3+1+0	4	4
Elective-01	3+1+0	4	4
Core Course-19UPCSC2C05	0+0+4	4	2

* Algorithm – Lab			
Core Course-19UPCSC2C06 * Advanced Web Technology – Lab	0+0+4	4	2
SWAYAM / MOOC - 01 (Optional)			
Total			24
Semester-II			
Core Course-19UPCSC2C07 Distributed Operating System	3+1+0	4	4
Core Course-19UPCSC2C08 Advanced Java Programming	3+1+0	4	4
Core Course-19UPCSC2C09 Cryptography and Network Security	3+1+0	4	4
Elective-02	3+1+0	4	4
Elective-03	3+1+0	4	4
Core Course-19UPCSC2C10 * Advanced Java-Lab	0+0+4	4	2
Non-major Elective / Supportive Course	3+0+0	3	3
Human Rights			
Core Course-19UPCSC2C17 Soft Skill Development - Lab	0+0+2	2	2
SWAYAM / MOOC - 02 (Optional)			
Total			27
Semester-III			
Course-19UPCSC2C11 Digital Image Processing	3+1+0	4	4
Course-19UPCSC2C12	3+1+0	4	4

Internet of Things			
Course-19UPCSC2C13 Machine Learning	3+1+0	4	4
Elective-04	3+1+0	4	4
Elective-05	3+1+0	4	4
Core Course-19UPCSC2C14* Image Processing – Lab	0+0+4	4	2
Core Course-19UPCSC2C15* Mini Project - Machine Learning	0+0+4	4	2
SWAYAM / MOOC / - 03 (Optional)			
Total			24

Semester-IV			
Option-I			
Core Course-19UPCSC2C16 **Dissertation and Viva Voice (Industry/Research)**	-	-	17
Option-II			
Elective-06	3+1+0	4	4
Elective-07	3+1+0	4	4
Core Course-19UPCSC2C16 **Dissertation and Viva-Voce** **(Industry/Research)**	0+0+12	12	9
Total			17
Total no. of Credits **Core**			40
Practical			12
Elective			20
Supportive			3
Option-I/Option-II			17
Grand Total			92

10. Credit Calculation

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

CURRICULUM AND SCHEME OF EXAMINATIONS
Two year M. Sc-Computer Science Programme

Course	Number of Credits	Hours Per Week	Examination Duration (hrs)	Marks		
				I. A	ESE	Total
Semester-I						
Core Course-19UPCSC2C01 Design and Analysis of Algorithm	4	4	3	25	75	100
Core Course-19UPCSC2C02 Advanced Web Technology	4	4	3	25	75	100
Core Course-19UPCSC2C03 Advanced Data Base Management Systems	4	4	3	25	75	100
Core Course-19UPCSC2C04 Compiler Design	4	4	3	25	75	100
Elective-01	4	4	3	25	75	100

Core Course-19UPCSC2C05 * Algorithm – Lab	2	4	3	40	60	100
Core Course-19UPCSC2C06 * Advanced Web Technology – Lab	2	4	3	40	60	100
SWAYAM / MOOC -01 (Optional)						
Total	24					700

Semester-II						
Core Course-19UPCSC2C07 Distributed Operating System	4	4	3	25	75	100
Core Course-19UPCSC2C08 Advanced Java Programming	4	4	3	25	75	100
Core Course-19UPCSC2C09 Cryptography and Network Security	4	4	3	25	75	100
Elective-02	4	4	3	25	75	100
Elective-03	4	4	3	25	75	100
Core Course-19UPCSC2C10 * Advanced Java-Lab	2	4	3	40	60	100
Non-major Elective / Supportive Course	3	3	3	25	75	100

Core Course-19UPCSC2C17 Soft Skill Development - Lab	2	2	3	100	-	100
Human Rights		2	3	-	100	100
SWAYAM / MOOC -02 (Optional)	ADD ON COURSE					
Total	27					900

Semester-III						
Core Course-19UPCSC2C11 Digital Image Processing	4	4	3	25	75	100
Core Course-19UPCSC2C12 Internet of Things	4	4	3	25	75	100
Core Course-13 Machine Learning	4	4	3	25	75	100
Elective-04	4	4	3	25	75	100
Elective-05	4	4	3	25	75	100
Core Course-19UPCSC2C14 * Image Processing – Lab	2	4	3	40	60	100
Core Course-19UPCSC2C15 * Mini Project - Machine Learning	2	4	3	40	60	100
SWAYAM / MOOC - 03 (Optional)	ADD ON COURSE					
Total	24					700

Semester-IV						
Option-I						
Core Course-19UPCSC2C16 **Dissertation and Viva Voice (Industry/Research)**	17	-	-	50	150	200
Option-II						
Elective-06	4	4	3	25	75	100
Elective-07	4	4	3	25	75	100
Core Course-19UPCSC2C16 **Dissertation and Viva-Voce** **(Industry/Research)**	9	12	-	50	150	200
Grand Total	92					2500

***The additional list of experiments in computer laboratory may be added according to their needs related to the course**

LIST OF ELECTIVES **

1. **19UPCSC2E01** Advanced Computer Network
2. **19UPCSC2E02** Cloud Computing
3. **19UPCSC2E03** Web Services
4. **19UPCSC2E04** Object Oriented System Development
5. **19UPCSC2E05** Mobile Computing
6. **19UPCSC2E06** Wireless Networks
7. **19UPCSC2E07** Theory of Computation
8. **19UPCSC2E08** Optimization Techniques
9. **19UPCSC2E09** Embedded Systems
10. **19UPCSC2E10** WAP and XML
11. **19UPCSC2E11** Statistical Computing
12. **19UPCSC2E12** Software Project management
13. **19UPCSC2E13** Dot Net Programming
14. **19UPCSC2E14** Data Science and Big Data Analytics
15. **19UPCSC2E15** Soft Computing
16. **19UPCSC2E16** Data Mining
17. **19UPCSC2E17** Discrete Mathematics for Computing
18. **19UPCSC2E18** Operations Research
19. **19UPCSC2E19** Cyber Security

**** The Elective Courses may be updated as per the Current Trends in Computer Science by their respective Boards**

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

EVALUATION OF **EXTERNAL EXAMINATIONS QUESTION PAPER PATTERN**

Time duration: 3 Hours Max. Marks: 75

PART- A: 20× 1 = 20

Answer all the questions

(Objective type four questions from each unit)

PART- B: 3 × 5 = 15

Answer any three questions out of five questions

(Questions must be of type analytical)

PART- C: 5× 8 = 40

Answer all the questions

(Either or type for each unit)

PRACTICAL / SOFTWARE DEVELOPMENT

EVALUATION OF **INTERNAL ASSESSMENT**

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

Total	:	40 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**

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

M. Sc- COMPUTER SCIENCE - SYLLABUS
SEMESTER-I

CORE COURSE-19UPCSC2C01 **Credits: 4**

DESIGN AND ANALYSIS OF ALGORITHMS

Course Objective:

- To introduce the fundamental concepts of the algorithm and its performance analysis. To choose the appropriate data structure and algorithm design method for a specified application
- To apply design and analysis techniques for a Divide and Conquer algorithm to analyses the time and space complexity
- To apply design and analysis techniques for the greedy method algorithm to analyses the time and space complexity
- To apply design and analysis techniques for Dynamic Programming and Basic Traversal and Search Technique algorithm to analyses the time and space complexity
- To apply design and analysis techniques for Backtracking algorithm to analyses the time and space complexity

UNIT I

Introduction: Algorithm Definition – Algorithm Specification – Performance Analysis-Asymptotic Notations. Elementary Data Structures: Stacks and Queues – Trees – Dictionaries –Priority Queues – Sets and Disjoint Set Union – Graphs

UNIT II

Divide and Conquer: The General Method – Defective Chessboard – Binary Search – Finding The Maximum And Minimum – Merge Sort – Quick Sort – Selection - Strassen‟s Matrix Multiplication.

UNIT III

The Greedy Method: General Method - Container Loading - Knapsack Problem – Tree Vertex Splitting – Job Sequencing With Deadlines - Minimum Cost Spanning Trees – Optimal Storage On Tapes – Optimal Merge Patterns - Single Source Shortest Paths.

UNIT IV

Dynamic Programming: The General Method – Multistage Graphs – All-Pairs Shortest Paths – Single-Source Shortest Paths - Optimal Binary Search Trees - String Editing - 0/1 Knapsack - Reliability Design - The Traveling Salesperson Problem - Flow Shop Scheduling. **Basic Traversal and Search Techniques:** Techniques for Binary Trees – Techniques for Graphs – Connected Components and Spanning Trees – Biconnected Components and DFS.

UNIT V

Backtracking: The General Method – The 8-Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycles – Knapsack Problem Branch and Bound: Least Cost searched - 0/1 Knapsack Problem.

Text Book:

1. Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekaran, **Fundamentals of Computer Algorithms**, Universities Press, Second Edition, Reprint 2009.

Course Outcomes

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

S.No.	Course Outcomes	Knowledge Level	
CO1	Understand the fundamental concepts of the algorithm and its performance analysis. To choose the appropriate data structure and algorithm design method for a specified application	**K1, K2**	**LO**
CO2	Apply design and analysis techniques for a Divide and Conquer algorithm. Apply design and analysis techniques for the greedy method algorithm. Apply design and analysis techniques for Dynamic Programming and Basic Traversal and Search Technique algorithm to analyses the time and space complexity	**K3**	**IO**
CO3	Analyze the performance analysis for given algorithms approaches, techniques and methods	**K4,K5**	**HO**

Mapping with Programme Outcomes:

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

S- Strong; M-Medium; L-Low

COURE COURSE-19UPCSC2C02 **Credits: 4**

ADVANCED WEBTECHNOLOGY

Course Objectives:

- Explorethebackboneof web pagecreationbydeveloping.NETskill.
- Enrich knowledgeaboutHTMLcontrolandweb control classes
- Provide depth knowledgeabout ADO.NET
- Understandtheneed ofusability, evaluation methods forweb services

Unit 1:

OVERVIEWOFASP.NET-The.NET framework – Learning the .NET languages: Data types–Declaring variables-Scope and Accessibility- Variable operations-Object Based manipulation-Conditional Structures-Loop Structures-Functions and Subroutines. Types, Objects and Namespaces : The Basics about Classes- Value types and Reference types- Advanced class programming-Understanding name spaces and assemblies. Setting Up ASP.NET and IIS .

Unit – II

DevelopingASP.NETApplications-ASP.NET Applications: ASP.NET applications – Cod behind-The Global.asax application file- UnderstandingASP.NETClasses-ASP.NET Configuration. Web Form fundamentals: A simple page applet-Improving the currency converter – HTML control classes – The page class-Accessing HTML server controls. Web controls: WebControl Classes–Auto Post Back and WebControl events- Accessing web controls. Using VisualStudio.NET: Starting aVisualStudio.NET Project-Webform Designer-Writing code- Visual studio.NET debugging. Validation and Rich Controls: Validation- A simple Validation example- Understanding regular expressions-A validated customer form. State management-Tracing, Logging, and Error Handling.

Unit – III

Working with Data - Overview of ADO.NET - ADO.NET and data management-CharacteristicsofADO.NET-
ADO.NETobjectmodel.ADO.NETdataaccess:SQL basics– Select ,Update, Insert, Delete statements- Accessing data- Creating a connection- Using a command with a DataReader- Accessing Disconnected data - Selecting multiple tables – UpdatingDisconnecteddata.Databinding:SinglevalueDataBinding-Repeated value data binding-Data binding with databases. Data list – Data grid– Repeater–Files, Streams and Email– Using XML

Unit -IV

Web Services – Web services Architecture: Internet programming the nandnow-WSDL–SOAP-Communicatingwithawebservice-WebservicediscoveryandUDDI. Creating Web services: Web service basics – The Stock Quote web service – Documenting the web service- Testing the web service - Web service Data types-ASP.NET intrinsic objects. Using web services: Consuming a web service-Using the proxy class – An example with Terra Service.

Unit – V

Advanced ASP.NET - Component Based Programming: Creating a simple component –Properties and state-Database components-Using COM components. Custom controls: User Controls – Deriving Custom controls. Caching and Performance Tuning: Designing and scalability –Profiling-Catching-Output catching-Data catching. Implementing security: Determining security requirements – The ASP.NET security model-Forms authentication - Windows authentication.

TextBook:

1. Mathew MacDonald, "ASP.NET Complete Reference", TMH 2005.

Unit-I:(Chapters:1to4) Unit– II:(Chapters:5 to11)
Unit-III:(Chapters:10to17)
Unit– IV:(Chapters:18to20) Unit– V:(Chapters:21to24)

References:

1. Crouch Matt J, "ASP.NET andVB.NET Web Programming",Addison Wesley2002.

2. J.Liberty,D.Hurwitz, "ProgrammingASP.NET",ThirdEdition, O"REILLY,2006.

Course Outcomes

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

CO1:	Evaluateaweb pagewithWeb formfundamentalsand web control classes	K3	IO
CO2:	Recognizethe importanceofvalidation control,cookiesandsession	K1, K2	LO
CO3:	Applythe knowledgeof ASP.NETobject,ADO.NETdata access	K4, K6	HO

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

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	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

CORE COURSE –19UPCSC2C03 **Credits: 4**

ADVANCED DATABASE MANAGEMENT SYSTEMS

Course Objectives:

- To acquire knowledge of data models, Need of normalization and various database architecture.
- To get familiar with Distributed and Object based databases
- To analyze the various techniques of spatial databases and learn knowledge pattern of logic based databases
- To learn about XML hierarchical data model
- To realize various applications of multimedia and knowledge about temporal database

Unit-I:
Relational and parallel Database Design: Basics, Entity Types, Relationship Types, ER Model, ER-to-Relational Mapping algorithm. Normalization: Functional Dependency, 1NF, 2NF, 3NF, BCNF,4NF and 5NF. Architecture, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intra operation, Parallelism, Interoperation Parallelism.

Unit-II:
Distributed and Object based Databases: Architecture, Distributed data storage, Distributed transactions, Commit protocols, Concurrency control, Query Processing. Complex Data Types, Structured Types and Inheritance, Table Inheritance, array and Multiset, Object Identity and Reference Types, Object Oriented versus Object Relational.

Unit-III:
Spatial Database: Spatial Database Characteristics, Spatial Data Model, Spatial Database Queries, Techniques of Spatial Database Query, Logic based Databases: Introduction, Overview, Propositional Calculus, Predicate Calculus, Deductive Database Systems, Recursive Query Processing.

Unit-IV:
XML Databases: XML Hierarchical data model, XML Documents, DTD, XML Schema, XML Querying, XHTML, Illustrative Experiments.

Unit-V:
Temporal Databases: Introduction, Intervals, Packing and Unpacking Relations, Generalizing the relational Operators, Database Design, Integrity Constraints, Multimedia Databases: Multimedia Sources, Multimedia Database Queries, Multimedia Database Applications.

Text Book

1. Abraham Silberschatz, Henry F Korth , S Sudarshan, "Database System Comcepts", 6th edition ,McGraw-Hill International Edition , 2011 Unit-I : (Chapters: 2,7,18), Unit – II: (Chapters: 19,22), Unit – IV: (Chapters: 23), Unit – V: (Chapters: 25)
2. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education Reprint 2016. Unit-I : (Chapters: 11,12,14), Unit – II: (Chapters: 23), Unit – IV: (Chapters: 24)

Reference Books:

1. Ramez Elmasri, Shamkant B Navathe, "Fundamental of Database Systems", Pearson, 7th edition 2016.

2. Thomas Connolly, Carolyn Begg., "Database Systems a practical approach to Design , Implementation and Management ", Pearson Education, 2014.

Course Outcomes

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

CO1:	Understand the Concepts of Relational database, parallel Database, Distributed database, Object based Databases, Spatial database and temporal database	K1,K2	LO
CO2:	Apply Query Statements for Create Table, Insert Data and Alter Data	K3	IO
CO3:	Analyze the concepts need of normalization, various Normal forms, spatial and temporal database	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
CO2	M	M	M	M	M	-	-	-	-	M	M	M
CO3	S	S	S	S	S	-	-	-	-	S	-	S

S- Strong; M-Medium; L-Low

CORE COURSE-19UPCSC2C04 **Credits : 4**

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

COURSE- 19UPCSC2C05 **Credits: 2**

ALGORITHM - LAB

1. Apply the divide and conquer technique to arrange a set of numbers using merge sort.
2. Apply the divide and conquer technique to implement Strassen‟s matrix multiplication Algorithm
3. Computer the transitive closure of a given directed graph using Warshall‟s Algorithm.
4. Implement 0/1 knapsack problem using Dynamic programming
5. Find minimum cost spanning tree of a given undirected graph using Kruskal‟s Algorithm.
6. Find minimum cost spanning Tree of a given undirected graph using Prim‟s Algorithm.
7. Implement 8 Queen‟s problem using backtracking
8. Implement Knapsack problem using backtracking
9. Solve Dljkstra‟s Algorithm using greedy technique
10. Solve subset sum problem using backtracking

COURSE- 19UPCSC2C06 **Credits: 2**

ADVANCED WEB TECHNOLOGY - LAB

Course Objectives:

- Learn how to create websites using Asp.Net
- Implement the advanced web concepts using Asp.Net and Ado.Net
- Learn to use Asp.Net web controls
- Design web applications using Asp.Net and Ado.Net

List of Programs:

Programs using ASP.NET Server controls

1. Create a website for a bank and include types of navigation.
2. Write a program to perform Asp.Net State.
3. Design Image Mapping using Asp.Net
4. Create the following using web controls
   a) Money conversion
   b) Temperature conversion
5. Write a program to create an advertisement using Ad rotator.
6. Create a user control that contains a list of colors. Add a button to the Web Form which when clicked changes the color of the Form to the color selected from the list.
7. Create a user control that displays the current date and time. Include it in a Web Form and refresh it each time a button is clicked.
8. Create a user control that receives the user name and password from the user and validates them. If the user name is “Radiant” and the password is “asp.net” then the user is authorized, otherwise not.

Programs using ADO.NET and ASP.NET

1. Create a web application to insert 3 records inside the SQL database table having following fields(DeptId, DeptName, EmpName, Salary). Update the salary for any one employee and increment it to 15% of the present salary. Perform delete operation on 1 row of the database table.
2. Create a Web App to display all the Empname and Deptid of the employee from the database using SQL source control and bind it to GridView. Database fields are(DeptId, DeptName, EmpName, Salary)

Course Outcomes:

- Apply .NET concepts to design and develop web applications
- Create a basic website using Asp.Net concepts
- Design web page and connect to the backend databases
- Applying different functionalities in Asp.Net and Ado.Net

CORE COURSE – 19UPCSC2C07 **Credits: 4**

DISTRIBUTED OPERATING SYSTEM

Course Objectives:

- To study features of Distributed operating system.
- To understand the communication of different hardware and software environment in distributed environment.
- To learn the distributed resource management components.
- To gain knowledge on modern operating system working principles.
- To learn about the different fault tolerance mechanisms.

UNIT I:

Introduction – Operating System Definition – Functions of Operating System – Types of Advanced Operating System – Design Approaches – Synchronization Mechanisms – concepts of a Process – Critical Section Problem – Process Deadlock – Models of Deadlock – Conditions for Deadlock – System with single-unit requests, Consumable Resources , Reusable Resources.

UNIT II:

Distributed Operating Systems: Introduction- Issues – Communication Primitives – Inherent Limitations –Lamport‟s Logical Clock , Vector Clock, Global State , Cuts – Termination Detection – Distributed Mutual Exclusion – Non Token Based Algorithms – Lamport‟s Algorithm - Token Based Algorithms –Distributed Deadlock Detection – Distributed Deadlock Detection Algorithms – Agreement protocols.

UNIT III:

Distributed Resource Management – Distributed File Systems – Architecture – Mechanisms – Design Issues – Distributed shared Memory – Architecture – Algorithm – Protocols – Design Issues – Distributed Scheduling – Issues – Components – Algorithms.

UNIT IV:

Failure Recovery and Fault Tolerance – Concepts – Failure Classifications – Approaches to Recovery – Recovery in Concurrent Systems – Synchronous and Asynchronous Check pointing and Recovery –Check pointing in Distributed Database Systems – Fault Tolerance Issues – TwoPhase and Nonblocking Commit Protocols – Voting Protocols – Dynamic Voting Protocols.

UNIT V:

Multiprocessor and Database Operating Systems –Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory management – Reliability/Fault Tolerance – Database Operating Systems –

concepts – Features of Android OS, Ubuntu, Google Chrome OS and Linux operating systems.

Text Books:

1. MukeshSinghalN.G.Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill 2000.

2. Distributed Operating System – Andrew S. Tanenbaum, PHI.

Reference Books:

1. Abraham Silberschatz, Peter B.Galvin, G.Gagne, "Operating Concepts", 6th Edition Addison Wesley publications 2003.

2. Andrew S.Tanenbaum, "Modern Operating Systems", 2nd Edition Addison Wesley 2001

Course Outcomes

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

CO1:	Understand the several resource management techniques like distributed shared memory and other resources.	K1, K2	LO
CO2:	Design and implement algorithms of distributed shared memory and commit protocols.	K3	IO
CO3:	Apply and implement fault tolerant distributed systems.	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

CORE COURSE –19UPCSC2C08 **Credits:4**

ADVANCED JAVA PROGRAMMING

Course Objectives:

- To get familiar with the concept of packages, interface, Inheritance and Exception handling in java.
- To learn the concept of Graphical User Interface (GUI), Network Programming, and database manipulation
- Student will be able to develop web application using Java Servlet and Java Server Pages technology

UNIT – I

Data Types, Variables and Arrays: Primitive Types-Literals-Variables-Type Conversion and Casting- Arrays. Operators: Arithmetic- Bitwise-Relational-Boolean-Logical – Assignment-Conditional. Control Statements: Selection statements- Iteration Statements- Jump Statements. Classes and Methods: Fundamentals- Declaring objects- Methods- Constructors-Overloading Methods-Recursion – Nested and Inner Classes-Command Line Arguments.

UNIT–II

Inheritance: Basics-Super Class- Method Overriding- Abstract Classes. Packages and Interfaces: Packages- Access Protection – Importing Packages- Interfaces. Exception Handling: Fundamentals – Types – Try and Catch – Throw – throws-Finally – Built in Exceptions.

UNIT–III

The Applet Class: Basics – Architecture – Applet Skeleton – Display Methods – Status Window- Passing Parameters. Event Handling: Event Model – Classes – KeyEventClass- Event Listner Interfaces. AWT: Window Fundamentals – Working with frame windows- Graphics- Working with color- working with fonts. AWT controls – Labels- Buttons- Check Box- Choice Controls – Lists- Scroll Bars – Text Field- Text Area.

UNIT–IV

Servlet Fundamentals: Servlet overview and Architecture- Servlet Basics- Servlets and HTML- servlet Sessions- Servlets, JDBC, and Inter Servlet Communications. JSP Fundamentals: JSP Overview and Architecture – JSP Implicit Objects – JSP Standard Actions- Handling JSP Errors – Custom JSP Tag Libraries.

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, "Java the Complete Reference", 9th ed., Oracle Press, TMH Company Ltd, New Delhi, 2014.
   Chapters: 3-10, 23-26
2. James goodwill, " Developing Java Servlets: Web applications with servlets and JSP", 2nd ed., SAMS Publishers, USA
   Chapters:2,3,4,5,7,14,15,16,18,19
3. Joe Wiggles worth and Paula McMillan, "Java Programming Advanced Topics", 3rd ed., TMH, 2009.
   Chapters: 9, 11.

Reference books

6. John Dean, Raymond Dean, "Introduction to Programming with JAVA- A Problem Solving Approach", Tata McGraw Hill, 2012.
7. Ralph Bravaco, Shai Simonson, "Java Programming: From the Ground Up", Tata McGraw Hill, 2012.
8. Herbert Schildt, Dale Skrien, " Java Fundamentals – A Comprehensive Introduction", Tata McGraw Hill, 2013

Course Outcomes

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

CO1:	Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem	K1, K2	LO

CO2:	Identify and describe common abstract user interface components to design GUI in Java using Applet & AWT along with response to events	K3	IO
CO3:	Apply Servlets and JSP for creating Web based applications using JDBC	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

CORE COURSE – 19UPCSC2C09 **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:

Introduction - Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

Unit II:

Symmetric Encryption and Message Confidentiality - Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4 , Chipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. Public-key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Key Management.

Unit III:

Authentication Applications - Kerberos, x.509 Authentication Service, Public-Key Infrastructure. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.

Unit IV:

IP Security - IP Security Over view, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations. Web Security: Web Security Considerations, Secure Socket Layer(SSL) and Transport Layer Security(TLS), Secure Electronic Transaction(SET).Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3.

Unit V :

Intruders - Intruders, Intrusion Detection, Password Management. **Malicious Software:** Virus and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks. **Firewalls:** Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation.

Text books:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007, Reprint 2015.
2. Stallings William, "Cryptography and Network Security - Principles and Practice 2017.
3. William Stallings, "Network Security Essentials Applications and Standards "Third Edition, Pearson Education, 2008.

References:

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms And Protocols", Wiley Publications, 2003.
2. Charles Pfleeger, "Security In Computing", 4th Edition, Prentice Hall Of India, 2006.
3. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
4. Charlie Kaufman And Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication In Public World", PHI 2002.
5. Bruce Schneier And Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
6. Douglas R Simson "Cryptography – Theory And Practice", First Edition, CRC Press, 1995.
7. Http://Nptel.Ac.In/.

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- 19UPCSC2C10 **Credits: 4**

ADVANCED JAVA LAB

Course 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. 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

2. Use GridLayout to design a calculator and simulate the functions of simple calculator.

3. To create Input output and Random files

4. To develop chat application with datagram sockets and datagram packets.

5. To invoke servlet from HTML forms.

6. To invoke servlet from Applets.

7. To invoke servlet from JSP.

8. Simple client/server application.

9. JDBC to interact with database.

10. To create multiple chat applications using TCP packets.

COURSE- 19UPCSC2C17 **Credits: 2**

SOFT SKILL DEVELOPMENT LAB

Course Objective

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

List of Programs

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

SEMESTER - III

CORE COURSE – 19UPCSC2C11 **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 basedcoding - 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

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	M	M	-
CO3	S	S	S	S	S	S	-	-	S	-	S	S

S- Strong ; M-Medium ; L-Low

CORE COURSE – 19UPCSC2C12 **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

CORE COURSE – 19UPCSC2C13 **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 ρ -Confidence Interval for the Mean Value of y Given x - Prediction Interval for a Randomly Chosen Value of y Given x - Transformations to Achieve Linearity-Box–Cox Transformations

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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

Text Book: Daniel T. Larose , Chantal D. Larose, Data mining and Predictive analytics, Second Ed., Wiley Publication, 2015.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

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**	**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	-	M	M
CO3	-	S	-	S	S	-	-	-	S	S	S	S

S- Strong ; M-Medium; L-Low

Course: 19UPCSC2C14 **Credits: 2**

IMAGE PROCESSING - LAB

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 clustering concept using K-means algorithm

Reference Website

1. https://opencv-pythontutroals.readthedocs.io/en/latest/py_tutorials/py_gui/py_image_display/py_imag e_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: 19UPCSC2C15 **Credits: 2**

MINI PROJECT - MACHINE LEARNING

The students are expected to develop Machine Learning Models. The mini project report may contain the following:

1. Introduction
2. Data Collection
3. System development
4. Implementation
5. Conclusion

LIST OF ELECTIVES

Course : 19UPCSC2E01 **Credits:4**

ADVANCED COMPUTER NETWORKS

Course Objectives:

- To study communication network protocols, different communication layer structure
- To learn security mechanism for data communication

Unit 1:

Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP models – Example networks: Internet, 3G Mobile phone networks, Wireless LANs –RFID and sensor networks - Physical layer – Theoretical basis for data communication - guided transmission media

Unit-2:

Wireless transmission - Communication Satellites – Digital modulation and multiplexing - Telephones network structure – local loop, trunks and multiplexing, switching. Data link layer: Design issues – error detection and correction.

Unit 3:

Elementary data link protocols - sliding window protocols – Example Data Link protocols – Packet over SONET, ADSL - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols.

Unit 4:

Network layer - design issues - Routing algorithms - Congestion control algorithms – Quality of Service – Network layer of Internet- IP protocol – IP Address – Internet Control Protocol.

Unit 5:

Transport layer – transport service- Elements of transport protocol - Addressing, Establishing & Releasing a connection – Error control, flow control, multiplexing and crash recovery - Internet Transport Protocol – TCP - Network Security: Cryptography.

Text Book:

1. S. Tanenbaum, 2011, Computer Networks, Fifth Edition, Pearson Education, Inc.

Reference Books:

1. **B. Forouzan, 1998, Introduction to Data Communications in Networking, Tata McGraw Hill, New Delhi.**
2. F. Halsall, 1995, Data Communications, Computer Networks and Open Systems, Addison Wessley.
3. D. Bertsekas and R. Gallagher, 1992, Data Networks, Prentice hall of India, New Delhi.
4. Lamarca, 2002, Communication Networks, Tata McGraw Hill, New Delhi.
5. Teresa C.Piliouras, "Network Design Management and Technical Perspectives, Second Edition", Auerbach Publishers, 2015.

Website, E-learning resources:

1) http://peasonhighered.com/tanenbaum

Course Outcomes

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

CO1:	Understand the concepts of the OSI reference model and the TCP-IP reference model	K1, K2	LO
CO2:	Apply the protocols, network interfaces, and design/performance issues in local area networks and wide area networks.	K3	IO
CO3:	Analyze and design with contemporary issues in networking technologies.	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: 19UPCSC2E02 **Credits: 4**

CLOUD COMPUTING

Course Objective:

- The objective of this course is to provide students with the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications by introducing and researching state-of-the-art in Cloud Computing fundamental issues, technologies, applications and implementations. Another objective is to expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

UNIT - I:
COMPUTING BASICS
Cloud computing definition- Characteristics- Benefit-Challenges- Distributed Systems- Virtualization-Service-oriented computing- Utility-oriented computing- Building Cloud Computing environments- computing platforms & technologies - Cloud Models – Cloud Service Examples - Cloud Based Services & Applications - Cloud concepts and Technologies.

UNIT - II:
VIRTUALIZATION, CLOUD SERVICES AND PLATFORMS
Virtualization:Virtualization- Characteristics- taxonomy-types- Pros and Cons- Examples Architecture: Reference model- types of clouds- Compute Service - Storage Services - Cloud Database Services - Application Services - Content Delivery Services - Analytics Services - Deployment And Management Service - Identity And Access Management Services - Open Source Private Cloud Software.

UNIT – III:
CLOUD APPLICATION DESIGN AND DEVELOPMENT
Design consideration- Reference Architecture for Cloud Application - Cloud Application Design Methodologies - Data Storage Approaches- Development in Python: Design Approaches – Application: Image Processing - Document Storage - Map Reduce - Social Media Analytics.

UNIT – IV:
PYTHON FOR CLOUD
Introduction- Installing Python- Data types & Data Structures- Control Flow- Functions- Modules- Packages- File Handling-Date/Time Operations – Classes- Python for Cloud: Amazon Web Services –Google Cloud Platform - Windows Azure –Map Reduced –Packages of Interest – Designing a RESTful Web API.

UNIT – V:

BIG DATA ANALYTICS, MULTIMEDIA CLOUD & CLOUD SECURITY

Big Data Analytics: Clustering Big data - Classification of Big Data – Recommendation systems. Multimedia Cloud: Case Study: Live Video Stream App - Streaming Protocols – Case Study: Video Transcoding App-Cloud Security: CSA Cloud Security Architecture - Authentication - Authorization - Identity and Access management - Data Security - Key Management- Auditing- Cloud for Industry, Healthcare & Education.

Text Books:

1. Buyya, Vecciola and Selvi, Mastering Cloud Computing: Foundations and Applications Programming, Tata McGraw Hill, 2013.
2. ArshdeepBahga, Vijay Madisetti, "Cloud Computing: A Hands – On Approach" Universities press (India) Pvt. limited 2016.

References:

1. Rittinghouse and Ransome, Cloud Computing: Implementation, Management, and Security, CRC Press, 2016.
2. Michael Miller "Cloud Computing Web based application that change the way you work and collaborate online". Pearson edition, 2008.
3. Kris Jamsa, Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Jones & Bartlett Learning, 2012.

Course Outcomes

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

CO1:	Understand the cloud computing and a systematic knowledge of the fundamental technologies, architecture, and security.	K1, K2	LO
CO2:	Apply the different Cloud Services in different environment	K3	IO
CO3:	Analyze and design public and private cloud using python language	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: 19UPCSC2E03 **Credits: 4**

WEB SERVICES

Course Objectives:

- To enable the student to be familiar with distributed services, XML and web services
- To study the use of web services in B2C and B2B applications

Unit – I

Overview of Distributed Computing. Introduction to web services – Industry standards, Technologies and concepts underlying web services – their support to web services. Applications that consume web services.

Unit – II

XML – its choice for web services – network protocols to back end databases- technologies – SOAP, WSDL – exchange of information between applications in distributed environment – locating remote web services – its access and usage. UDDI specification – an introduction.

Unit - III

A brief outline of web services – conversation – static and interactive aspects of system interface and its implementation, work flow – orchestration and refinement, transactions, security issues – the common attacks – security attacks facilitated within web services quality of services – Architecting of systems to meet users requirement with respect to latency, performance, reliability, QOS metrics, Mobile and wireless services – energy consumption, network bandwidth utilization, portals and services management.

Unit – IV

Building real world enterprise applications using web services – sample source codes to develop web services – steps necessary to build and deploy web services and client applications to meet customer s requirement – Easier development, customization, maintenance, transactional requirements, seamless porting to multiple devices and platforms.

Unit - V

Deployment of Web services and applications onto Tomcat application server and axis SOAP server (both are free wares) – Web services platform as a set of enabling technologies for XML based distributed computing.

Textbooks:

1. Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services : An Architects Guide , Prentice Hall, Nov 2003.
2. Heather Williamson, “XML: The Complete Reference “,Tata McGraw-Hill Education India.

References:

1. Martin Kalin, "Java Web Services: Up and Running", O"Reilly Publishers.

Course Outcomes

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

CO1:	Understand the design principles and application of SOAP and REST based web services.	K1, K2	LO
CO2:	Design collaborating web services according to a specification	K3	IO
CO3:	Implement an application that uses multiple web services in a realistic business scenario. Use industry standard open source tools such as Apache Axis2, Tomcat, Derby and Eclipse to build, test, deploy and execute web services and web applications that consume them.	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	-	-	-	-	-	-	-
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

COURSE: 19UPCSC2E04 **Credits: 4**

OBJECT ORIENTED SYSTEMS DEVELOPMENT

Courser Objectives:

- Introduce the concept of Object-oriented design and understand the fundamentals of OOSD life cycle.
- Familiar with evolution of object-oriented model, classes and it notations
- Practice UML in order to express the design of software projects.
- Specify, analyze and design the use case driven requirements for a particular system.
- Enrich knowledge about DBMS, designing classes and object oriented testing.

Unit - I

Fundamentals of OOSD - Overview of Object Oriented Systems Development: Two orthogonal view of the software - OOSD methodology - Why an object? Object orientation. Object basics: Object Oriented Philosophy- Objects – Attributes – Object respond to messages – Encapsulation and information hiding – class hierarchy – Polymorphism – Object relationship and associations. OOSD life cycle : Software development process – OOSD Use case Driven Approach – Reusability.

Unit – II

Methodology, Modeling and UML - Object Oriented Methodologies: Rumbaugh et al.'s object modeling technique – The Booch methodology – The Jacobson et al. methodology – Patterns – Frameworks - The Unified approach. Unified Modeling Language : Static and dynamic models – Why modeling - UML diagrams – UML class diagram – Use case diagram - UML dynamic modeling – packages and model organization.

Unit – III

Object Oriented Analysis - Object Oriented Analysis process : Business Object Analysis - Use case driven object oriented analysis – Business process modeling – Use-Case model – Developing effective documentation . Classification : Classifications theory – Approaches for identifying classes – Noun phrase approach – Common class patterns approach – Use-Case Driven approach – Classes, Responsibilities, and Collaborators - Naming classes. Identifying object relationships, attributes, and methods : Association – Super-Sub class relationship – Aggregation – Class responsibility – Object responsibility.

Unit – IV

Object Oriented Design - Object Oriented Design Process and Design Axioms - OOD process-OOD axioms – Corollaries – Design patterns. Designing classes : Designing classes – Class visibility – Refining attributes – Designing methods and protocols – Packages and managing classes. Access layer: Object Store and persistence – DBMS – Logical and physical Database Organization and access control – Distributed Databases and Client Server Computing — Multidatabase Systems – Designing Access layer classes. View Layer : Designing view layer

classes – Macro level process – Micro level process – The purpose of view layer interface – Prototyping the user interface.

Unit – V

Software Quality - Software Quality Assurance : Quality assurance tests – Testing strategies – Impact of Object Orientation on Testing - Test Cases- Test Plan – Continuous testing. System Usability and Measuring User satisfaction: Usability Testing – User satisfaction test – A tool for analyzing user satisfaction. System Usability and Measuring User satisfaction : Introduction – Usability Testing.

Text Book:

1. Ali Bahrami, "Object Oriented Systems Development using UML", McGraw-Hill, 2008

References:

1. Booch Grady, Rumbaugh James, Jacobson Ivar, "The Unified modeling Language – User Guide, Pearson Education, 2006
2. Brahma Dathan, Sarnath Ramnath, "Object Oriented Analysis, Design and Implementation", Universities Press, 2010.
3. Mahesh P.Matha, "Object-Oriented Analysis and Design Using UML", PHI Learning Private Limited, 2012.
4. Rachita Misra, Chhabi Rani Panigrahi, Bijayalaxmi Panda, "Principles of Software Engineering and System Design", Yesdee Publishing 2019.

Course Outcomes

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

CO1:	Understand the function of test cases, testing strategies and test plans in developing object-oriented software.	K1, K2	LO
CO2:	Recognize the difference between various object relationships: inheritance, association and aggregation.	K3	IO
CO3:	Analyze, design, document the requirements through use case driven approach.	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: 19UPCSC2E05 **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, GSM, CDMA.
- To introduce the WAP Architecture, MANET and Routing

Unit-I

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

Chapters: 1, 2.1 to 2.6

Unit-II

Spread spectrum – Direct sequence spread spectrum – Frequency hopping spread spectrum – Cellular systems. Medium access control: Hidden and exposed terminals – Near and far terminals – SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, slotted Aloha, Carrier sense multiple access – Reservation TDMA – Multiple access with collision avoidance – Polling – CDMA – Spread Aloha multiple access.
Chapters: 3.1 to 3.3, 3.4.1 to 3.4.4, 3.4.7 to 3.4.9, 3.5.1

Unit-III

GSM - Mobile services – System architecture – Radio interface – Protocols – Localization and calling – Handover – Security – New Data services. UMTS and IMT-2000 - Satellite Systems: Applications – Basics – Routing – Localization – Handover.
Chapters: 3.6, 4.1.1 to 4.1.8, 4.4, 5.2 to 5.6

Unit-IV

Wireless LAN: Infra red vs. radio transmission – Infrastructure and ad-hoc network – IEEE 802.11 – System architecture – Protocol architecture – Physics layer – Medium access control layer – MAC management – Blue tooth. Mobile network layer: Mobile IP: Goals, assumptions and requirements – entities and terminology – packet delivery – Agent discovery – Registration – Tunneling and encapsulation Recent technologies
Chapters: 7.1 to 7.3.5, 7.5, 8.1.1 to 8.1.6

Unit-V

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

Text Book:

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

Reference Books:

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

Course Outcomes

On successful completion of the course the student should

CO1:	Understand the different types of security features and MANET routing	K1,K2	LO
CO2:	Apply different mobile applications	K3	IO
CO4:	Analyzing the concepts of Routing Protocols in MANET. Analyzing the concepts of Global System for Mobile Communication	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
CO3	-	-	-	S		-	-	S	S	S	S	-

S- Strong; M-Medium; L-Low

COURSE: 19UPCSC2E06 **Credits: 4**

WIRELESS NETWORKS

Course Objectives:

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

Unit 1:

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

Unit 2:

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 3:

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 4:

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 5 :

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 book

1. Jochen Schiller, ”Mobile Communications”, Second Edition, Pearson Education 2012.(Unit I,II,III)
2. Vijay Garg , “Wireless Communications And Networking”, First Edition, Elsevier 2014.(Unit IV,V)

References:

1. Erik Dahlman, Stefan Parkvall, Johan Skold And Per Beming, "3G Evolution HSPA And LTE For Mobile Broadband", Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy Kuri, "Wireless Networking", First Edition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013.
4. David G. Messerschmitt, "Understanding Networked Applications", Elsevier, 2010.

Course Outcomes

Upon Completion of the course, the 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	Design and Implement Wireless Network Environment For Any Application Using Latest Wireless Protocols And Standards.	**K3**	**IO**
CO3	Analyze the fundamentals of Mobile Transport Layer and Classical TCP Improvement. 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	**K4,K5, K6**	**HO**

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

Mapping with Programme Outcomes:

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

S- Strong; M-Medium; L-Low

COURSE: 19UPCSC2E07 **Credits: 4**

THEORY OF COMPUTATION

Course Objectives:

- The learning objectives of this course are to introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
- To enhance /develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

Unit 1:

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

Unit 2:

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

Unit 3:

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

Unit 4:

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

Unit 5:

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

Textbook:

1. Peter Linz, "An Introduction to Formal Languages and Automata", Third Edition ,Narosa, 2005
2. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and
Computations", second Edition, Pearson Education, 2007.

Reference Books:

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

Course Outcomes

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

CO1:	Understand the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.	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: 19UPCSC2E08 **Credits: 4**

OPTIMIZATION TECHNIQUES

Course Objective

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

Unit – I : Linear Programming Problem

Linear Programming Problem (LPP): Mathematical Formulation of Linear Programming Problem - Graphical Solution of LPP - canonical and standard forms of linear programming problem- Simplex method for solving LPP

Unit – II : Transportation and Assignment Problems

Transportation Model: North West corner Method, Least cost method, and Vogel's Approximation Method. Assignment Model : Hungarian assignment model – Travelling Sales Man Problem.

Unit – III : CPM/PERT

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

Unit – IV : Non-Linear Optimization Models

Simplex Method – Gradient of function – Steepest Descent method – Conjugate Gradient method

Unit – V : Unconstraint Optimization Models

Particle Swarm Optimization method – Ant Colony optimization algorithm – Fruit Fly method – Fire Fly method

Text Book

1. Kanti Swarup, P. K. Gupta and Man Mohan, Operations Research, Sultan Chand and Sons, New Delhi, 2014. (Unit 1, 2, and 3)
2. S. S. Rao, Engineering Optimization: Theory and Practice, JOHN WILEY & SONS, INC., 2009. (Unit 4)
3. Bo Xing and Wen-Jing Gao, Innovative Computational Intelligence: A Rough Guide to 134 Clever Algorithms, Springer, 2014.(Unit 5)

Reference Books:

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

Course outcome

On successful completion of the course, the students will

CO1:	Understand the concept of optimization	K1,K2	LO
CO2:	Formulate the Mathematical Model on various applications	K3	IO
CO4:	Solve the Linear Programming Problems using different models	K4,K5,K6	HO

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

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	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: 19UPCSC2E09 **Credits: 4**

EMBEDDED SYSTEMS

Course Objectives:

This course will enable students to:

- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Describe the hardware software co-design and firmware design approaches
- Know the RTOS internals, multitasking, task scheduling, task communication and synchronisation
- Learn the development life cycle of embedded system

Unit-I

Introduction to Embedded system - Embedded system vs General computing systems - History - Classification - Major Application Areas - Purpose of Embedded systems - Smart running shoes: The innovative bonding of lifestyle with embedded technology. Characteristics and Quality Attributes of Embedded systems

Unit-II

Elements of an Embedded system - core of the embedded system: General purpose and domain specific processors, ASICs, PLDs, COTS - Memory - Sensors and Actuators - Communication Interface: Onboard and External Communication Interfaces - Embedded Firmware - Reset circuit, Brown-out protection circuit, Oscillator unit, Real-time clock, and Watchdog timer - PCB and Passive Components

Unit-III

Embedded Systems - Washing machine: Application-specific - Automotive: Domain specific. Hardware Software Co-Design - Computational Models - Embedded Firmware Design Approaches - Embedded Firmware Development Languages - Integration and testing of Embedded Hardware and firmware.

Unit-IV

RTOS based Embedded System Design: Operating System Basics - Types of operating Systems - Tasks, process and Threads - Multiprocessing and Multitasking - Task Scheduling- Task Communication - Task Synchronisation - Device Drivers - choosing an RTOS.

Unit-V

Components in embedded system development environment, Files generated during compilation, simulators, emulators and debugging - Objectives of Embedded product Development Life Cycle - Different Phases of EDLC - EDLC Approaches - Trends in Embedded Industry - Case Study: Digital Clock.

Text Book:

1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009.

Reference Books:

1. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", TMH. Second Edition 2009
2. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley. Third Edition 2006
3. Cliff Young, Faraboschi Paolo, and Joseph A. Fisher, "Embedded Computing: A VLIW Approach to Architecture, Compilers and Tools", Morgan Kaufmann Publishers, An imprint of Elsevier, 2005.
4. David E. Simon, "An Embedded Software Primer" Pearson Education, 1999

Course Outcomes

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

CO1:	Understand the of interrupts, hyper threading and software optimization.	K1, K2	LO
CO2:	Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.	K3	IO
CO3:	Analyze and Design real time embedded systems using the concepts of RTOS.	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: **19UPCSC2E10**
Credits: 4

WAP and XML

Course Objectives:

- The purpose of the course is to impart knowledge on eXtensible Markup Language (XML) and to achieve secured, messaging through web services.

Unit-I

Overview of WAP: WAP and the wireless world – WAP application architecture – WAP internal structure – WAP versus the Web – WAP 1.2 – WTA and push features. Setting up WAP: Available software products – WAP resources – The Development Toolkits.

Unit- II

WAP gateways: Definition – Functionality of a WAP gateway – The Web model versus the WAP model – Positioning of a WAP gateway in the network – Selecting a WAP gateway Basic WML: Extensible markup language – WML structure – A basic WML card – Text formatting – navigation – Advanced display features.

Unit-III

Interacting with the user: Making a selection – Events – Variables – Input and parameter passing. WML Script: Need for WML script – Lexical Structure – Variables and literals – Operators – Automatic data type conversion – Control Constructs Functions – Using the standard libraries – programs – Dealing with Errors.

Unit-IV

XML: Introduction XML: An Eagle's Eye view of XML – XML Definition – List of an XML Document – Related Technologies – An introduction to XML Applications – XML Applications – XML for XML – First XML Documents Structuring Data: Examining the Data XMLizing the data – The advantages of the XML format – Preparing a style sheet for Document Display.

Unit-V

Attributes, Empty Tags and XSL: Attributes – Attributes Versus Elements – Empty Tags

– XSL – Well formed XML documents – Foreign Languages and Non Roman Text – Non Roman Scripts on the Web Scripts, Character sets, Fonts and Glyphs – Legacy character sets– The Unicode Character set – Procedure to Write XML Unicode.

Text Books:

1. For Unit I, II, III
   Charles Arehart and Others. "Professional WAP with WML, WML script, ASP, JSP, XML, XSLT, WTA Push and Voice XML" Shroff Publishers and Distributers Pvt. Ltd 2000.
2. For Unit IV & V
   Eliotte Rusty Harlod "XML TM Bible", Books India (P) Ltd, 2000

References

1. Heather Williamson, "XML: The Complete Reference ",Tata McGraw-Hill Education India.

Course Outcomes

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

CO1:	Understand the XML and Web Services	K1, K2	LO
CO2:	Apply XML concepts to develop Web application.	K3	IO
CO3:	Develop SOA application using XML and Web Services. Extract information from the web sites using XML programming	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

S- Strong ; M-Medium; L-Low

COURSE: 19UPCSC2E11 **Credits: 4**

Statistical Computing

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.

References:

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

Outcomes:

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

- Data analytics from a database formed from the real world problem
- Predict the exact reason for the real time issues

Course Outcomes

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

CO1:	Understand the Data analytics from a database formed from the real world problem	K1, K2	LO
CO2:	Apply the Predict the exact reason for the real time issues.	K3	IO
CO3:	Analyze and design predict the exact reason for the real time 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	-	-	-	-
CO3	-	-	-	-	-	-	S	S	S	S	S	S

S- Strong ; M-Medium; L-Low

COURSE: 19UPCSC2E12 **Credits: 4**

Software Project management

Course Objectives:
This course will enable students to:

- Understand the framework of project management
- Learn to monitor and control the project
- Know the sound knowledge in Agile method
- Know the team, cost, quality and resource management
- Identify and control the risk in the projects

Unit-I

Project Management Framework: Introduction: Project - Project management - Relationship among Project, Program and Portfolio management - Project and operations management- Role of project manager - Project management body of knowledge - Enterprise Environmental factors. Project life cycle and Organization: Overview of project life cycle - Projects vs Operational Work - Stakeholders - Organizational influences on project management. **The Standard for Project Management of a Project**: Project management processes for a project: Common project management process interactions - Projects management process groups - Initiating process group - planning process group - Executing process group - Monitoring and controlling process group - Closing process group.

Unit-II

Choosing Methodologies and Technologies – Software Processes and Process Models – Choice of Process Models – The Waterfall Model– Prototyping – other ways of categorizing prototype - **Agile Methods** – Extreme Programming Selecting the Most Appropriate Process Model- Need of Agile - Iterative vs Incremental-Agile Manifesto and Mindset – Lean, Scrum and Kanban methods-uncertainty, Risk, and lifecycle selection-Scrum Elements overview-5 levels of planning-Scrum Process overview- Agile Team-roles and responsibilities- Epic-feature-User Stories-PBI-The Sprint.

Unit-III

The Project Management Knowledge Areas: Project integration management: Develop project charter - Develop project management plan - Direct and manage project execution - Monitor and control project work - Perform integrated change control - Close project or phase. Project scope management: Collect requirements - Define Scope - Create WBS - Verify Scope - Control Scope. Project team management: Define activities - Sequence activities - Estimate activity resources - Estimate Activity Durations - Develop Schedule - Control Schedule.

Unit-IV

Project cost management: Estimate costs - Determine budget - Control costs. Project Quality Management: Plan quality - perform quality assurance - Perform quality control. Project Human Resource Management: Develop human resource plan - Acquire project team - Develop project team - Manage project team. Project Communications Management: Identify stakeholders - Plan communications - Distribute information - Manage stakeholder expectations - report performance.

Unit-V

Project Risk Management: Plan risk management - Identify risks - Perform qualitative risk analysis - Perform quantitative risk analysis - plan risk responses - Monitor and control risks. Project Procurement Management: Plan - Conduct - Administer - Close procurements.

Text Book:

1. "A guide to the Project management Body of Knowledge (PMBOK Guide)" Fouth Edition, Project Management Institute, Pennsylvania, 2008
2. BOB Huges, Mike Cotterell, Rajib Mall “Software Project Management”, McGraw Hill, Fifth Edition,2011.
3. Emerson, "Agile Handbook," Philosophie

Reference books:

1. Futrell, “Quality Software Project Management”, Pearson Education India.
2. Royce, “Software Project Management”, Pearson Education India.
3. C.Ravindranath Pandian, “Applied Software Risk Management-A Guide for Software Project Managers”, Auerbach Publications, 2015.
4. Benjamin A. Lieberman, “The Art of Software Modeling”, Auerbach Publications, 2010.

Outcomes:

- Analyze the scope, cost, timing, and quality of the project, at all times focused on project success as defined by project stakeholders.
- Align the project to the organization's strategic plans and business justification throughout its lifecycle.
- Identify project goals, constraints, deliverables, performance criteria, control needs, and resource requirements in consultation with stakeholders.
- Implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.
- Adapt projects in response to issues that arise internally and externally.

Course Outcomes

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

CO1:	Understand the project goals, constraints, deliverables, performance criteria, control needs, and resource requirements in consultation with stakeholders.	K1, K2	LO
CO2:	Apply the Implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.	K3	IO
CO3:	Analyze the scope, cost, timing, and quality of the project, at all times focused on project success as defined by project stakeholders.	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	-	-	-	-
CO2	-	-	-	M	M	-	M	M	M	M	M	-
CO3	-	-	-	S	S	-	S	S	S	S	S	S

S- Strong ; M-Medium; L-Low

COURSE: 19UPCSC2E13 **Credits: 4**

DOT NET PROGRAMMING

Course Objectives:

- To explore the backbone of web page creation by developing .NET skill.
- To Familiar with Application, session and view state management
- To Provide depth knowledge about ADO.NET
- To Understand the need of usability, evaluation methods for web services
- To acquire knowledge on the usage of recent platforms in developing web applications

Unit – I :

The .NET Framework - Learning the .NET languages - Introduction - Net revolution - .Net framework and its architecture – CLR – What is Assembly – Components of Assembly – DLL hell and Assembly Versioning- O Objects and Namespaces - Setting Up ASP.NET and IIS

Unit – II *:*

Developing VB.NET Applications - Introduction to VB.Net, The .Net Frame work and Common language runtime, Building VB. Net Application, VB IDE, forms, properties, events, VB language-console application and 46 windows application, data type, declaring variable, scope of variable, operators and statements - Windows Applications-forms, adding controls to forms, handling events, MsgBox, Input Box, multiple forms, handling mouse and Keyboard events, object oriented programmingcreating and using classes and objects, Handling Exceptions- on Error Goto

Unit – III:

Developing ASP.NET Applications - ASP.NET Applications – Understanding ASP.NET Controls - Overview of ASP.NET framework, Web Form fundamentals - Web control classes – Using Visual Stdio.NET - Validation and Rich Controls -State management – Tracing, Logging, and Error Handling.

Unit – IV*:*

Developing C#.NET Applications - Introducing C# - overview of C# - Literals,Variables-Data Types, -Operators, -checked and unchecked operators – Expressions – Branching - Looping-*Object Oriented Aspects Of C#:* Class – Objects - Constructors and its types-inheritance, properties, indexers, index overloading – polymorphism - sealed class and methods - interface, - abstract class, operator overloading, - delegates, events, errors and exception - Threading.

Unit – V:

ADO.NET - Overview of ADO.NET - ADO.NET data access – Connected and Disconnected Database, Create Connection using ADO.NET Object Model, Connection Class, Command Class Data binding – Data list – Data grid – Repeater – Files, Streams and Email – Using XML.

Text Books:

1. Struts: The Complete Reference,James Holmes 2nd Edition 2007 McGraw Hill Professional
2. Mathew Mac Donald, "ASP.NET Complete Reference", TMH 2005
3. Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012.
4. Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012
5. ASP.NET Unleashed, C# programming – Wrox publication
6. Visual Basic. NET Black Book, by Steven Holzner

Reference Books:

1. Jesse Liberty , „Programming C#, " , 4th Edition, O'Reilly Media
2. Mario Szpuszta, Matthew MacDonald , "Pro ASP.NET 4 in C# 2010: Includes Silverlight 2,"Apress, Third Edition
3. J.Liberty, D.Hurwitz, "Programming ASP.NET", Third Edition, O"REILLY, 2006.
4. Visual Basic. Net programming in easy steps by Tim Anderson, Dreamtech Press

Course Outcomes

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

CO1:	Understand the major programming paradigms and techniques involved in design and implementation of modern programming languages	K1, K2	LO
CO2:	Apply the about Microsoft .NET framework and ASP.Net applications using standard .net controls.	K3	IO
CO3:	Create and develop an ability to use current techniques, skills, and tools necessary for computing practice.	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	-	-	-
CO2	-	-	-	M	M	-	M	M	M	M	M	-
CO3	-	S	S	-	-	-	S	S	S	S	S	S

S- Strong ; M-Medium; L-Low

COURSE: 19UPCSC2E14 **Credits: 4**

DATA SCIENCE AND BIG DATA ANALYTICS

Course Objectives:

- The course provides grounding in basic and advanced methods to big data technology and tools, including MapReduce and Hadoop and its ecosystem.

Unit-I : Introduction to Big Data Analytics : Big Data Overview – Data Structures – Analyst Perspective on Data Repositories - State of the Practice in Analytics – BI Versus Data Science - Current Analytical Architecture – Drivers of Big Data – Big Data Ecosystem - Data Ana lytics Lifecycle – Data Discovery – Data Preparation – Model Planning – Model Building – Communicate Results – Operationalize.

Unit-II : Basic Data Analytic Methods Using R : Introduction to R programming – R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics Exploratory Data Analysis : Visualization Befor Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables Data Exploration Versus Presentation -– Statistical Methods of Evaluation : Hypothesis Testing – Difference of Means – Wilcoxon Rank-Sum Test – Type I and Type II Errors – Power and Sample Size – ANOVA..

Unit-III : Advanced Analytical Theory and Methods: Clustering – K Means – Use Cases – Overview – Determining number of clusters – Diagnostics – Reasons to choose and cautions – Additional Algorithms - Association Rules : A Priori Algorithm – Evaluation of Candidate Rules – Applications of Association Rules – Validation and Testing – Diagnostics. Regression : Linear Regrression and Logistic Regression :– Use cases – Model Description – Diagnostics - Additional Regression Models.

Unit-IV : Classification : Decision Trees – Overview – Genetic Algorithm – Decision Tree Algorithms – Evaluating Decision Tree – Decision Trees in R - Na‟ive Bayes – Bayes Theorem – Naïve Bayes Clasifier – Smoothing – Diagnostics – Naïve Bayes in R – Diagnostics of Classifiers – Additional Classification Methods - Time Series Analysis : : Overview – Box – Jenkins Methodology – ARIMA Model – Autocorrelation Function – Autoregressive Models – Moving Average Models – ARMA and ARIMA Models – Building and Evaluating and ARIMA Model - Text Analysis : Text Analysis Steps – Example – Collecting – Representing Term Frequency – Categorizing – Determining Sentiments – Gaining Insights.

Unit-V : Advanced Analytics-Technology and Tools: MapReduce and Hadoop : Analytics for Unstructured Data .- *UseCases* - *MapReduce* - Apache Hadoop – The Hadoop Ecosystem – pig – Hive – Hbase – Manout – NoSQL - Tools in Database Analytics : SQL Essentials – Joins – Set operations – Grouping Extensions – In Database Text Analysis - Advanced SQL – Windows Functions – User Defined Functions and Aggregates – ordered aggregates- MADiib - Analytics Reports Consolidation – Communicating and operationalizing and Analytics Project – Creating the Final Deliverables : Developing Core Material for Multiple Audiences – Project Goals – Main Findings – Approach Model Description – Key points support with Data - Model details – Recommendations – Data Visualization

Text Book :

1. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services Published by John Wiley & Sons, Inc. 2015

Reference Books :

1. Noreen Burlingame , "The little book on Big Data", New Street publishers, 2012.
2. Anil Maheshwari, " Data Analytics", McGraw Hill Education, 2017.
3. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press; 1 edition , 2011.
4. Sandip Rakshit, "R for Beginners", McGraw Hill Education, 2017
5. http://www.johndcook.com/R_language_for_programmers.html.
6. http://bigdatauniversity.com/.
7. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction.

Course Outcomes

On successful completion of the course the student should

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: 19UPCSC2E15 **Credits: 4**

SOFT COMPUTING

Course Objectives:

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- Introduce students to artificial neural networks and fuzzy theory from an engineering perspective.

UNIT- I:

Introduction: Soft Computing Constituents – Soft Computing Vs Hard Computing –
Characteristics - Applications - Artificial Neural Network (ANN): Fundamental Concept – Application Scope - Basic Terminologies – Neural Network Architecture – Learning Process – Basic Models of ANN: McCulloch-Pitts Model – Hebb Network – Linear Separability.

UNIT- II:

Supervised Learning Networks: Perceptron Networks – Adaline and Madaline Networks – Back
Propagation Network – Radial Basis Function Network. Associative Memory Networks – BAM
- Hopfield Network - Boltzmann Machine. Unsupervised Learning Networks: Kohonen Self
Organizing Network – Counter Propagation Network – ART
Network.

UNIT- III:

Fuzzy Sets: Basic Concept – Crisp Set Vs Fuzzy Set - Operations on Fuzzy Set – Properties of Fuzzy Sets – Fuzzy Relations: Concept – Fuzzy Composition – Fuzzy Equivalence and Tolerance Relation - Membership Functions: Features – Fuzzification – Methods of Membership value assignments – Defuzzification – Methods.

UNIT -IV:

Fuzzy Arithmetic – Extension Principle – Fuzzy Measures – Fuzzy Rules and Fuzzy Reasoning:
Fuzzy Propositions – Formation of Rules – Decomposition of Rules – Aggregation of Rules – Approximate Reasoning – Fuzzy Inference and Expert Systems – Fuzzy Decision Making – Fuzzy Logic Control Systems.

UNIT -V:

Genetic Algorithm: Fundamental Concept – Basic Terminologies – Traditional Vs Genetic

Algorithm - Elements of GA - Encoding - Fitness Function – Genetic Operators: Selection – Cross Over - Inversion and Deletion - Mutation – Simple and General GA – The Schema Theorem - Classification of Genetic Algorithm – Genetic Programming – Applications of GA.

Text Book:

1. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Wiley India, 2007.

Reference Book

1. S. Rajasekaran, G.A.V. Pai, "Neural Networks, Fuzzy Logic, Genetic Algorithms", Prentice Hall India, 2004.

Course Outcomes

Upon completion of the course, the student are expected to

CO1:	Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic. Understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations. Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.	K1, K2	LO
CO2:	Analyze and integrate various soft computing techniques in order to solve problems effectively and efficiently	K4	IO
CO3:	Evaluate effectively use existing software tools to solve real problems using a soft computing approach	K4, K6	HO

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

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	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: 19UPCSC2E16 **Credits: 4**

DATA MINING

Course Objectives:

- To introduce the fundamental concepts of Data Mining Techniques and various Algorithms used for Information Retrieval from Datasets.

Unit I **Data Mining And Data Preprocessing**: Data Mining – Motivation – Definition – Data Mining on Kind of Data –Functionalities – Classification – Data Mining Task Primitives – Major Issues in Data Mining – Data Preprocessing – Definition – Data Clearing – Integration and Transformation – Data Reduction.

Unit II

Data Warehousing: Multidimensional Data Model –Data Warehouse Architecture – Data Warehouse Implementation –From data Warehousing to Data Mining – On Line Analytical Processing - On Line Analytical Mining.

Unit III

Frequent Patterns, Associations And Classification: The Apriori Algorithm – Definition of Classification and Prediction – Classification by Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Lazy Learners – K-Nearest Neighbor – Other Classification Methods.

Unit IV

Cluster Analysis: Definition – Types of data in Cluster Analysis – Categorization of major Clustering Techniques – Partitioning Methods – Hierarchical Clustering – BIRCH - ROCK – Grid Based Methods – Model Based Clustering Methods – Outlier Analysis.

Unit V

Spatial, Multimedia, Text And Web Data: Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web – Data Mining Applications – Trends in Data Mining.

Text Books:

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques (The Morgan Kaufmann Series in Data Management Systems) 3rd Edition, July 6, 2011.
2. Ian H. Witten, Eibe Frank, Mark A. Hall, "Data Mining: Practical Machine Learning Tools and Techniques", Elsevier; Third edition, 2014.

References:

1. Margret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2003.
2. M. Awad, Latifur Khan, Bhavani Thuraisingham, Lei Wang, "Design and Implementation of Data Mining Tools", CRC Press-Taylor & Francis Group, 2015.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining-Instructor"s Solution Manual", Pearson Education, First Edition, 2016.
4. Mohammed J.Zaki, Wagner Meira JR, "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge India, 2016.

Outcome:

- After completing this course, students will be familiar with basic data mining concepts for solving real world problems.

Course Outcomes

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

CO1:	Understand the basic data mining concepts and algorithms	K1, K2	LO
CO2:	Apply the different clustering algorithms	K3	IO
CO3:	Analyze and design datamining 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	-
CO3	-	-	-	-	-	-	S	S	S	S	S	S

S- Strong ; M-Medium; L-Low

COURSE:19UPCSC2E17 **Credits: 4**

DISCRETE MATHEMATICS FOR COMPUTING

(Theorems and Proofs are not expected)

Course objectives:

- 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

Wellformed 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.

Course outcome

On successful completion of the course, students will

- solve problems in mathematical logic
- identify and apply basic concepts of set theory, arithmetic, logic, proof techniques, binary relations, graphs and trees
- solve recurrence relations
- construct lattice applications
- understand the applications of Graph Theory in Computer Science.

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)

Reference Books

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 use of well formed formula ,logical connectives, predicates of formula and so on	K4,K6	LO
CO2:	Evaluate Relations, functions , recurrence relations and their types	K3	IO
CO3:	Apply lattices with use of Hassee diagram and study of its properties and various study of different graphs.	K4, K5, K6	HO

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	-	-
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 – 19UPCSC2E18 **Credits: 4**

OPERATIONS RESEARCH

Course Objectives:

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

Unit – I

Linear Programming Problem (LPP): Formulations and graphical solution of (2 variables) canonical and standard terms of linear programming problem.

Unit – II

Algebraic Solution: Simplex algorithm - Simplex methods – solving problems with slack 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 - Problems in mortality and staffing.

Unit – V

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

Text Books

1. KantiSwarup - P.K. Gupta &Manmohan – Operation Research 1996.
2. S.Kalavathy: Operations Research – Second Edition – Vikas Publishing House Pvt.Ltd. – 2004.

Course Outcomes

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

CO1:	Understand the optimization	K1, K2	LO
CO2:	Apply the optimization algorithms and linear programs	K3	IO
CO3:	Develop mathematical model of real life cases	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
CO 1	L	L	L	L	-	L	-	L	L	L	-	-
CO 2	-	-	-	M	M	-	M	M	M	M	M	-
CO 3	-	-	-	-	-	-	S	S	S	S	S	S

S- Strong ; M-Medium; L-Low

COURSE-19UPCSC2E19 **Credits: 4**

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-post mortmem versus live forensics – computer analysis for the hacker defender program-network analysis – legal issues of intercepting wifi transmission – wifi technology – wifi RF-scanning RF – eavesdropping on wifi – fourth amendment expectation of privacy in WLAN.

Unit – IV

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

Unit – V

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

Text books:

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

Reference Books:

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

Course Outcomes

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

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

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

Mapping with Programme Outcomes

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	S	L	-	L	M	L	M	M	-	M	-	-
CO2	M	S	-	L	M	L	M	M	-	M	-	-
CO3	M	S	L	L	M	L	M	M	-	M	M	L

S- Strong; M-Medium; L-Low