Master of

Computer Science

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]

[Accredited by NAAC with 'A' Grade with CGPA of 3.27]

[Recognized 2(f) & 12(B) Status under UGC Act of 1956]

Katteri – 636 902, Uthangarai (Tk), Krishnagiri (Dt)

Tamil Nadu, India

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DEGREE OF MASTER OF SCIENCE IN COMPUTER SCIENCE

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS FOR

M.Sc. COMPUTER SCIENCE PROGRAMME

(SEMESTER PATTERN)

(For Students Admitted in the College from the Academic Year 2024-2025 Onwards)

REGULATIONS AND SYLLABUS FOR MSC COMPUTER SCIENCE PROGRAMME

(For Students Admitted in the College from the Academic Year 2024-2025 Onwards)

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1. VISION OF THE DEPARTMENT

To uplift the economically and educationally backward students by developing the personality of the individual, instilling high levels of discipline and preparing them to strive, to set global standards that contributes to the development of the society.

2. MISSION OF THE DEPARTMENT

Impart the knowledge of recent technologies and equip the students with essential skills, technologically make them updated by creating intellectually inspiring environment for Learning, Research, Creativity, Innovation and Professional activities, enable them to become knowledgeable, motivated and resourceful IT professionals.

3. DEFINITIONS

(i) Programme: Programme means a course of study leading to the award of the degree in a discipline.

(ii) Course: Course refers to the subject offered under the Degree Programme.

4. AIM OF THE PROGRAMME

1. To produce the Post Graduate in Computer Science with strong technical and theoretical knowledge of computer science.
2. Impart quality education and provide technical skills in Computer Science through best of practices.
3. To produce graduates who can contribute professionally to the society and employed in research and development units of industries and academic institutions.
4. The Department will produce graduates who work productively as IT professional both at supportive and leadership roles.
5. Advance effectively in their chosen career path utilizing technical abilities, leadership qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.
6. Effectively utilizing their knowledge of computing principles and mathematical theory to develop sustainable solutions to present and future computing problems.
7. Possess employability and entrepreneurship skills.
8. Enable students to prepare for competitive examinations such as NET, SET, TNPSC with teaching and research qualification.

5. PROGRAMME OUTCOMES (PO)

PO1	**Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.
PO2	**Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision making.
PO3	**Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.
PO4	**Communication Skill** Ability to develop communication, managerial and interpersonal skills.
PO5	**Individual and Team Leadership Skill** Capability to lead themselves and the team to achieve organizational goals.
PO6	**Employability Skill** Inculcate contemporary business practices to enhance employability skills in the competitive environment
PO7	**Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur.
PO8	**Contribution to Society** Succeed in career endeavors and contribute significantly to society.
PO9	**Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective.
PO10	**Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one‟s life

6. PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1	**Placement** To prepare the students who will demonstrate respectful engagement with others ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.

PSO2	**Entrepreneur** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.
PSO3	**Research and Development** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development
PSO4	**Contribution to Business World** To produce employable, ethical and innovative professionals to sustain in the dynamic business world
PSO5	**Contribution to the Society** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

7. ELIGIBILITY FOR ADMISSION

A candidate who has passed in B.Sc Computer Science / B.C.A / B.Sc Computer Technology / B.Sc Information Science / B.Sc Information Technology degree of Periyar University or any of the degree of any other University accepted by the Governing Body of the Sri Vidya Mandir Arts & Science College as equivalent thereto, subject to such conditions as may be prescribed therefore are eligible to appear and qualify for the M.Sc Computer Science degree examination of this Autonomous College affiliated to Periyar University after a course of study of two academic years.

8. 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 consists of 90 working days (450 hours).

9. FEATURES OF CHOICE BASED CREDIT SYSTEM

Under Choice Based Credit System (CBCS), a set of Courses consisting of Core Courses, Elective Courses, Skill Based Elective Courses and Extra Disciplinary Course are offered. Beside the Core Courses, which are totally related to the major subjects, the students have the advantage of studying supportive courses and non-major courses. This provides ample

opportunity for the students to learn not only the major subjects but also inter disciplinary and application-oriented subjects.

10. SYLLABUS

The syllabus of the MSc Computer Science Degree Programme is divided into the following Courses:

(i) **Core Courses**: The Core Courses are related to the Programme concerned practicals and project offered under the Programme.

(ii) **Elective Courses:** There are FIVE Elective Courses offered under the Programme related to the major or non-major but are to be selected by the students.

(iii) **Non-Major Elective (NME):** Students are expected to opt NME (Non major elective) offered by other departments.

(iv) **Extra Credit Courses:** In order to facilitate the students gaining extra credits, the Extra Credit Courses are offered. According to the guidelines of the UGC, the students are encouraged to avail this option of enriching the knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals, such as SWAYAM, NPTEL, etc.

11. PROGRAMME OF STUDY

The Programme of study for the Degree shall be in the Branch – Computer Science (Choice Based Credit System) with internal assessment comprised of instructions in the following subjects according to the syllabi and books prescribed from time to time.

12. CREDIT

Weightage given to each course of study is termed as Credit.

13. CREDIT SYSTEM

The weightage of credits is spread over to four different semesters during the period of study and the cumulative credit point average shall be awarded based on the credits earned by the student. A total of 92 Credits are prescribed for the MSc Computer Science Degree Programme which is the minimum Credit requirement for the two year MSc Computer Science Degree Programme.

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

Master of Science (M.Sc.) in Computer Science

Programme Pattern and Syllabus (CBCS)

(For Students Admitted in the College from the Academic Year 2024-2025 Onwards)

SI. No	Part	Nature of Course	Course Code	Name of the Course	Hours/ Week	Credits	Marks		
							CIA	ESE	Total
SEMESTER – I									
1	III	Core – I	24PCS1C01	Analysis and Design of Algorithms	6	5	25	75	100
2		Core – II	24PCS1C02	Object Oriented Analysis and Design & C++	6	5	25	75	100
3		Core – III	24PCS1C03	Python Programming	6	4	25	75	100
4		Elective - I			4	3	25	75	100
5		Core Practical – I	24PCS1P01	Algorithm and OOPs Lab	4	3	40	60	100
6		Core Practical – II	24PCS1P02	Python Programming Lab	4	3	40	60	100
Total					**30**	**23**	**180**	**420**	**600**
SEMESTER – II									
7	III	Core – IV	24PCS2C04	Data Mining and Warehousing	5	4	25	75	100
8		Core – V	24PCS2C05	Advanced Operating Systems	5	4	25	75	100
9		Core – VI	24PCS2C06	Advanced Java Programming	5	4	25	75	100
10		Elective – II			4	3	25	75	100
11		Core Practical – III	24PCS2P03	Data Mining Lab using R	4	4	40	60	100
12		Core Practical – IV	24PCS2P04	Advanced Java Programming Lab	4	4	40	60	100
13	IV	Common Course	24P2HR01	Fundamentals of Human Rights	3	2	25	75	100
Total					**30**	**25**	**205**	**495**	**700**

SEMESTER – III									
14	III	Core - VII	24PCS3C07	Digital Image Processing	6	5	25	75	100
15		Core - VIII	24PCS3C08	Cloud Computing	5	5	25	75	100
16		Core - IX	24PCS3C09	Network Security and Cryptography	5	5	25	75	100
17		Core - X	24PCS3C10	Data Science & Analytics	6	4	25	75	100
18		Core Practical – V	24PCS3P05	Digital Image Processing using MATLAB Lab	3	3	40	60	100
19		Core Practical – VI	24PCS3P06	Cloud Computing Lab	3	2	40	60	100
20	IV	Internship	24PCS3IN01	Internship Industrial Activity	2	2	40	60	100
Total					**30**	**26**	**220**	**480**	**700**
SEMESTER – IV									
21	III	Elective – III			4	3	25	75	100
22		Core Practical – VII	24PCS4P07	Web Application development & hosting Practical	5	5	40	60	100
23		Project	24PCS4PR01	Project work and Viva voce	-	7	50	150	200
24	IV	Skill Enhancement Course		Professional Competency Skill	4	2	40	60	100
25	V		24P4EX01	Extension Activities	-	1	-	-	-
Total					**13**	**18**	**155**	**345**	**500**
Grand Total					**103**	**92**	**760**	**1740**	**2500**

Note

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

Discipline Electives

Elective Course – I

Semester	Paper	Course Code	Name of the Course
I	I	24PCS1E01	Advanced Software Engineering
	II	24PCS1E02	Multimedia and its applications
	III	24PCS1E03	Embedded Systems

Elective Course – II

Semester	Paper	Course Code	Name of the Course
II	I	24PCS2E04	Artificial Intelligence & Machine Learning
	II	24PCS2E05	Internet of Things
	III	24PCS2E06	Mobile Computing

Elective Course – III

Semester	Paper	Course Code	Name of the Course
IV	I	24PCS4E07	Critical thinking, Design thinking and problem solving
	II	24PCS4E08	Web Services
	III	24PCS4E09	Robotic process automation for business

NME-NON-MAJOR ELECTIVE

Students are expected to opt NME (Non major elective) offered by other departments.

Semester	Course Code	Name of the Course
II	24PCS2N01	Principles of Information Technology
	24PCS2N02	Fundamentals of Computers and Communications
	24PCS2N03	E-Commerce

14. BREAK-UP OF MARKS AND CREDITS

The break-up of marks and credits for the M.Sc. Computer Science Degree Programme is as follows:

Subject	Number of Subjects	Total Marks	Total Credits
Core Courses (Theory/ Practical)	17	1700	69
Elective Courses	03	300	9
Project	01	200	07
Common Course	01	100	02
Skill Enhancement Course	01	100	02
Internship	01	100	02
Extension Activities	01	-	01
Grand Total	**25**	**2500**	**92**

- The field trip preferably relevant to the course should be undertaken every year.

15. EXAMINATIONS

The examinations consist of Continuous Internal Assessment (CIA) and end of semester examinations (ESE). The ESE shall be of Three Hours duration for each theory course at the end of every semester. The candidate failing in any course(s) will be permitted to appear for each failed course(s) in the subsequent examination. At the end of fourth semester, the Project Viva-voce will be conducted on the basis of the Dissertation/Project Report of the students by the evaluation of one internal and one external examiner.

To maintain uniformity, particularly for interdepartmental transfer of credits, there shall be a uniform pattern of examination to be adopted by all the teachers offering courses. There shall be three tests, one seminar and one assignment for CIA and ESE during each semester. The distribution of marks for CIA and ESE shall be 25 marks and 75 marks, respectively. Further, the distribution of CIA will be 10 marks for test, 5 marks for seminar, 5 marks for attendance and 5 marks for assignment. The average of the highest two test marks out of the three CIA tests will be taken for CIA.

16. COMPONENTS OF CONTINUOUS INTERNAL ASSESSMENT (CIA)

Components		Marks	Total Marks
Theory			
CIA I	75	(75+75 = 150/15) 10	25
CIA II	75		
Seminar		05	
Attendance		05	
Assignment		05	
Practical			
CIA		25	40
Practical Observation Notebook		10	
Attendance		5	
Project			
Literature Collection		10	50
Data Collection		10	
Methodology		15	
Presentation of Result		15	

17. QUESTION PAPER PATTERN

Bloom's Taxonomy Based Assessment Pattern

(**K1** – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate; **K6** – Create)

(i) Theory Examinations (CIA I & CIA II = 25 Marks and ESE = 75 Marks)

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer ALL) Q1–Q15	15 × 1 = 15	Multiple Choice Questions (MCQ) (Three questions from each unit)	15
K2	B (Answer any THREE out of FIVE) Q16–Q20	3 × 5 = 15	Short Answers (One question from each unit)	15

K3 & K4	C (Either or Pattern) Q20–Q25	5 × 9 = 45	Descripitive/Detailed Answers (Two questions from each unit)	45
Total Marks				**75**

Passing Minimum (CIA) 50% = 12 Marks

Passing Minimum (ESE) 50% = 38 Marks

50 Marks

(ii) Practical Examinations (CIA = 40 Marks and ESE = 60 Marks)

Knowledge Level	Components	Marks	Total
K3, K4, K5	Experiments	50	60
	Record Work	10	

Passing Minimum (CIA) 50% = 20 Marks

Passing Minimum (ESE) 50% = 30 Marks

50 Marks

(iii) Project Viva-Voce (CIA = 50 Marks and ESE = 150 Marks)

Knowledge Level	Section	Marks	Total Marks
K3, K4 & K5	Project Dissertation	50	150
	Viva-voce	100	

Passing Minimum (CIA) 50% = 25 Marks

Passing Minimum (ESE) 50% = 75 Marks

100 Marks

The candidate shall be declared to have passed the examination if the candidates secure not less than 38 marks out of 75 marks in the semester examination in each theory course and 12 marks out of 25 marks in the CIA and in total not less than 50 marks.

For the practical course, 30 marks out of 60 marks in the semester examination and the record notebook taken together and 20 marks out of 40 marks in the CIA and in total 50 marks. There is no passing minimum for the record notebook. However, submission of the record notebook is necessary.

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

Candidate who does not obtain the required minimum marks for a pass in a Course/Practical/Project/Dissertation shall be declared Re-Appear (RA) and the candidate has to appear and pass the same at a subsequent appearance.

18. DISSERTATION

(a) Topic: The topic of the dissertation shall be assigned to the candidate before the beginning of fouth semester and a copy of the same should be submitted to the COE office for Approval.

(b) Number of Project/Dissertation copies to be submitted by the students

The students should prepare three copies of dissertation and submit the same 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 COE office and the student can have the rest.

(c) Format to be followed

The format of the Project/Dissertation to be prepared and submitted by the students in Semester IV is given below:

Format for the preparation of Project Work:

(i) Title Page:

TITLE OF THE PROJECT/DISSERTATION

A Project work submitted in partial fulfilment of the requirements for the degree of

Master of Science in Computer Science

to the

Sri Vidya Mandir Arts and Science College (Autonomous), Katteri, Uthangarai

Submitted by

Name of the Student

Reg. No.

Under the Guidance of

Name of the guide
(Designation, Name of the department)

College Logo

Name of the Department

College Name

(Affiliated to Periyar University)

Place with Pin Code

Month – Year

(ii) Bonafide Certificate:

CERTIFICATE

This is to certify that the dissertation entitled ……submitted in partial fulfilment of the requirement of the award of the Degree of Master of Science in Computer Science (Under Choice Based Credit System) to the Sri Vidya Mandir Arts and Science College, Katteri, Uthangarai, Krishnagiri Dt is a record of bonafide research work carried out by……..under my supervision and guidance and that no part of the dissertation has been submitted for the award of any degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journals or magazines.

Date:

Place: Signature of the Guide

Signature of the Head of the Department

(iii) Acknowledgement:

(Drafted by the student)

iv) Table of Contents:

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19. MAXIMUM DURATION FOR THE COMPLETION OF THE MSC COMPUTER SCIENCE PROGRAMME

The maximum duration for completion of the MSc Computer Science Programme shall not exceed eight semesters.

20. COMMENCEMENT OF THIS REGULATION

This regulation and syllabus shall take effect from the academic year 2020–2021 for students who are admitted to the first year of the Programme during the academic year 2020–2021 and thereafter.

21. GRADING

Once the marks of the cumulative CIA and ESE are available, they will be added. The marks thus obtained will then be graded as per details given below:

Marks and Grades:

The following table gives the marks grade points, letter grades and classification to indicate the performance of the candidate.

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

Ci = Credits earned for course i in any semester

Gi = Grade Point obtained for course i in any semester

n = Semester in which such course were credited

For a semester:

GRADE POINT AVERAGE [GPA] = $\Sigma i\ Ci\ Gi\ /\ \Sigma i\ Ci$

$$GPA = \frac{\text{Sum of the multiplication of grade points by the credits of the courses}}{\text{Sum of the credits of the courses in a semester}}$$

For the entire Programme:

CUMULATIVE GRADE POINT AVERAGE [CGPA] = Σi Ci Gi / Σi Ci

$$GPA = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

22. CLASSIFICATION OF SUCCESSFUL CANDIDATES

A candidate who passes all the examinations and securing following CGPA and Grades shall be declared as follows:

CGPA	GRADE	CLASSIFICATION OF FINAL RESULT
9.5–10.0	O+	First Class – Exemplary
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	

23. RANKING

A candidate who qualifies for the M.Sc Computer Science, passing all the Examinations in the first attempt within the minimum period prescribed for the Programme from the date of admission to the Programme and secures first or second class shall be eligible for ranking and such ranking will be confined to 10% of the total number of candidates qualified in that particular subject to a maximum of 10 ranks.

24. CONFERMENT OF THE DEGREE

No candidate shall be eligible for conferment of the Degree unless he/she has undergone the prescribed Programme of study for a period of not less than four Semesters in an Institution and earns has passed the Examinations as have been prescribed.

25. TRANSITORY PROVISION

Candidates who have undergone the Programme of Study prior to the Academic Year 2024–2025 will be permitted to take the Examinations under those Regulations for a period of four years i.e. up to and inclusive of the Examination of April 2028. Thereafter, they will be permitted to take the Examination only under the Regulations in force at that time.

PROGRAMME SYLLABUS

Program: M.Sc Computer Science				
Core – I	**Course Code:** 24PCS1C01		**Course Title:** Analysis and Design of Algorithms	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	6	90	5	100

Course Objectives

1. Enable the students to learn the Elementary Data Structures and algorithms.
2. Presents an introduction to the algorithms, their analysis and design
3. Discuss various methods like Basic Traversal and Search Techniques, divide and conquer method, Dynamic programming, backtracking
4. Understood the various design and analysis of the algorithms.

Unit:1 INTRODUCTION

Introduction: - Algorithm Definition and Specification – Space complexity-Time Complexity-Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heapsort- Graph.

Unit:2 TRAVERSAL AND SEARCH TECHNIQUES

Basic Traversal and Search Techniques: Techniques for Binary Trees-Techniques for Graphs - Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.

Unit:3 GREEDY METHOD

The Greedy Method: - General Method – Knapsack Problem – Minimum Cost Spanning Tree – Single Source Shortest Path.

Unit:4 DYNAMIC PROGRAMMING

Dynamic Programming - General Method – Multistage Graphs – All Pair Shortest Path – Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.

Unit:5 BACKTRACKING

Backtracking: - General Method – 8-Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Book

1. Ellis Horowitz, SartajSahni, Sanguthevar Rajasekiaran, “Computer Algorithms”, Second Edition, Silicon Press, 2007.

2. Alfred V.Aho, John E.Hopcroft, Jeffrey D.Ullman, "Data Structures and Algorithms", First Edition, Pearson Education India, 2002.

Reference Books

1. Goodrich, “Data Structures & Algorithms in Java”, Wiley 3rd edition, 2008.

2. Skiena,” The Algorithm Design Manual”, Second Edition, Springer, 2008.

3. AnanyLevith,” Introduction to the Design and Analysis of algorithm”, Pearson Education Asia, 2003.

4. Robert Sedgewick, Phillipe Flajolet,” An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company,1996.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3. https://www.javatpoint.com/daa-tutorial

Expected Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Get knowledge about algorithms and determines their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique.	K1, K2
CO2	Gain good understanding of Greedy method and its algorithm.	K2, K3
CO3	Able to describe about graphs using dynamic programming technique.	K3, K4
CO4	Demonstrate the concept of backtracking & branch and bound technique	K5, K6
CO5	Explore the traversal and searching technique and apply it for trees and graphs.	K6

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

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	L	M	L	S	M
CO2	S	S	S	S	S	M	S	M	S	M
CO3	S	S	S	S	S	M	S	M	S	M
CO4	S	S	S	S	S	M	S	M	S	M
CO5	S	S	S	S	S	M	S	M	S	M

*** S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Core – II	**Course Code:** 24PCS1C02		**Course Title:** Object Oriented Analysis and Design & C++	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	6	90	5	100

Course Objectives

The main objectives of this course are to:

1. Present the object model, classes and objects, object orientation, machine view and model management view.
2. Enables the students to learn the basic functions, principles and concepts of object-oriented analysis and design.
3. Enable the students to understand C++ language with respect to OOAD.

Unit:1 OBJECT MODEL

The Object Model: The Evolution of the Object Model – Elements of the Object Model – Applying the Object Model. Classes and Objects: The Nature of an Object – Relationship among Objects**.**

Unit:2 CLASSES AND OBJECTS

Classes and Object: Nature of Class – Relationship Among classes – The Interplay of classes and Objects. Classification: The importance of Proper Classification – identifying classes and objects – Key Abstractions and Mechanism.

Unit:3 C++ INTRODUCTION

Introduction to C++ – Input and output statements in C++ – Declarations – control structures – Functions in C++.

Unit:4 INHERITANCE AND OVERLOADING

Classes and Objects –Constructors and Destructors –operators overloading –Type Conversion Inheritance – Pointers and Array.

Unit:5 POLYMORPHISM AND FILES

Memory Management Operators- Polymorphism – Virtual functions – Files – Exception Handling – String Handling -Templates.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. "Object Oriented Analysis and Design with Applications", Grady Booch, Third Edition, Addison Wesley, 2007.

2 "Object Oriented Programming with ANSI & Turbo C++", Ashok N.Kamthane, First Indian Print, Pearson Education, 2003.

Reference Books

1. Balagurusamy "Object Oriented Programming with C++", TMH, Second Edition, 2003.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/
3. https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm

Expected Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of Object-Oriented development and modeling techniques	K1, K2
CO2	Gain knowledge about the various steps performed during object design.	K2, K3
CO3	Abstract object-based views for generic software systems	K3
CO4	Link OOAD with C++ language	K4, K5
CO5	Apply the basic concept of OOPs and familiarize to write C++ program	K5, K6

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

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	M	S	S
CO2	S	S	S	M	S	M	S	M	S	S
CO3	S	S	S	M	S	M	S	M	S	S
CO4	S	S	S	M	S	M	S	M	S	S
CO5	S	S	S	M	S	M	S	M	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – III	**Course Code:** 24PCS1C03		**Course Title:** Python Programming	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	6	90	4	100

Course Objectives

The main objectives of this course are to:

1. Presents an introduction to Python, creation of web applications, network applications and working in the clouds
2. Use functions for structuring Python programs
3. Understand different Data Structures of Python
4. Represent compound data using Python lists, tuples and dictionaries

Unit:1 INTRODUCTION

Python: Introduction – Numbers – Strings – Variables – Lists – Tuples – Dictionaries – Sets– Comparison.

Unit:2 CODE STRUCTURES

Code Structures: if, elseif, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.

Unit:3 MODULES, PACKAGES AND CLASSES

Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. Objects and Classes: Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent with super – In self Defense – Get and Set Attribute Values with Properties – Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.

Unit:4 DATA TYPES AND WEB

Data Types: Text Strings – Binary Data. Storing and Retrieving Data: File Input/Output – Structured Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores. Web: Web Clients – Web Servers – Web Services and Automation.

Unit:5 SYSTEMS AND NETWORKS

Systems: Files –Directories – Programs and Processes – Calendars and Clocks. Concurrency: Queues – Processes – Threads – Green Threads and gevent – twisted – Redis. Networks: Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – ZeroMQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and MapReduce – Working in the Clouds.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. Bill Lubanovic, “Introducing Python”, O‟Reilly, First Edition-Second Release, 2014.
2. Mark Lutz, “Learning Python”, O‟Reilly, Fifth Edition, 2013.

Reference Books

1. David M. Beazley,“Python Essential,.Developer‟s Library, Fourth Edition, 2009.
2. Sheetal Taneja, Naveen Kumar, “Python Programming-A Modular Approach, Pearson Publications, 2017.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.programiz.com/python-programming/
2. https://www.tutorialspoint.com/python/index.htm
3. https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

Expected Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic concepts of Python Programming.	**K1, K2**
CO2	Understand File operations, Classes and Objects	**K2, K3**
CO3	Acquire Object Oriented Skills in Python	**K3, K4**
CO4	Develop web applications using Python	**K5**
CO5	Develop Client Server Networking applications.	**K5, K6**

K1 - Remember, K2 - Understand, K3 - Analyse, K4 - Implement, K5 -Evaluate, K6- Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	S	M
CO5	S	S	S	S	S	S	S	M	S	M

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core Practical – I	**Course Code:** 24PCS1P01		**Course Title:** Algorithm and OOPs Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	3	100

Course Objectives

The main objectives of this course are to:

1.This course covers the basic data structures like Stack, Queue, Tree, List.

2. This course enables the students to learn the applications of the data structures using various techniques

3. It also enable the students to understand C++ language with respect to OOAD concepts

4. Application of OOPS concepts

LIST OF PROGRAMS

1) Write a program to solve the tower of Hanoi using recursion.
2) Write a program to traverse through binary search tree using traversals.
3) Write a program to perform various operations on stack using linked list.
4) Write a program to perform various operations in circular queue.
5) Write a program to sort an array of an elements using quick sort.
6) Write a program to solve number of elements in ascending order using heap sort.
7) Write a program to solve the knapsack problem using greedy method
8) Write a program to search for an element in a tree using divide & conquer strategy.
9) Write a program to place the 8 queens on an 8X8 matrix so that no two queens Attack.
10) Write a C++ program to perform Virtual Function
11) Write a C++ program to perform Parameterized constructor
12) Write a C++ program to perform Friend Function
13) Write a C++ program to perform Function Overloading
14) Write a C++ program to perform Single Inheritance
15) Write a C++ program to perform Employee Details using files.

Text Books

1. Goodrich, "Data Structures & Algorithms in Java", Wiley 3rd edition, 2008.
2. Skiena," The Algorithm Design Manual", Second Edition, Springer, 2008

Reference Books

1. AnanyLevith," Introduction to the Design and Analysis of algorithm", Pearson Education Asia, 2003.
2. Robert Sedgewick, Phillipe Flajolet, "An Introduction to the Analysis of Algorithms", Addison-Wesley Publishing Company, 1996.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1.https://onlinecourses.nptel.ac.in/noc19_cs48/preview

2.https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/

3.https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the concepts of object oriented with respect to C++	**K1, K2**
CO2	Able to understand and implement OOPS concepts	**K3, K4**
CO3	Implementation of data structures like Stack, Queue, Tree, List using C++.	**K4, K5**
CO4	Application of the data structures for Sorting, Searching using different techniques.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Core Practical – II	**Course Code:** 24PCS1P02		**Course Title:** Python Programming Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	3	100

Course Objectives

The main objectives of this course are to:

1. This course presents an overview of elementary data items, lists, dictionaries, sets and tuples
2. To understand and write simple Python programs
3. To Understand the OOPS concepts of Python
4. To develop web applications using Python

LIST OF PROGRAMS

Implement the following in Python:

1. Write a program to create, append, and remove lists.
2. Write a program to demonstrate working with tuples.
3. Write a program to demonstrate working with dictionaries.
4. Write a program to compute summary statistics such as mean, median, mode, standard Deviation and variance.
5. Working with Numpy arrays.
6. Working with Pandas data frames.
7. Develop program for Frequency distributions.
8. Working with Basic plots using Matplotlib.
9. Working with Normal curves using Matplotlib.
10. Program to demonstrate Regression analysis.

Text Books

1. Bill Lubanovic, “Introducing Python”, O‟Reilly, First Edition-Second Release, 2014.
2. Mark Lutz, “Learning Python”, O‟Reilly, Fifth Edition, 2013.

Reference Books

1. David M. Beazley, "Python Essential Reference", Developer's Library, Fourth Edition, 2009.
2. Sheetal Taneja, Naveen Kumar, "Python Programming- A Modular Approach", Pearson Publications, 2017.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1 https://www.programiz.com/python-programming/
2 https://www.tutorialspoint.com/python/index.htm
3 https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Able to write programs in Python using OOPS concepts	**K1, K2**
CO2	To understand the concepts of File operations and Modules in Python	**K2, K3**
CO3	Implementation of lists, dictionaries, sets and tuples as programs	**K3, K4**
CO4	To develop web applications using Python	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

***S – Strong,** **M – Medium,** **L – Low**

Program: M.Sc Computer Science				
Core – IV	**Course Code:** 24PCS2C04		**Course Title:** Data Mining and Warehousing	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	5	75	4	100

Course Objectives

The main objectives of this course are to:

1. Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.
2. Develop skills of using recent data mining software for solving practical problems.
3. Develop and apply critical thinking, problem-solving, and decision-making skills.

Unit:1 BASICS AND TECHNIQUES

Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective. **Data mining techniques**: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.

Unit:2 ALGORITHMS

Classification: Introduction – Statistical – based algorithms - distance – based algorithms- decision tree - based algorithms - neural network – based algorithms –rule - based algorithms – combining techniques.

Unit:3 CLUSTERING AND ASSOCIATION

Clustering: Introduction – Similarity and Distance Measures – Outliers – Hierarchical Algorithms - Partitional Algorithms. Association rules: Introduction - large item sets - basic algorithms – parallel & distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.

Unit:4 DATA WAREHOUSING AND MODELING

Data warehousing: introduction - characteristics of a data warehouse – data marts – other aspects of data mart. Online analytical processing: introduction - OLTP & OLAP systems Data modeling –star schema for multidimensional view –data modeling – multifact star schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.

Unit: 5 APPLICATIONS OF DATA WAREHOUSE

Developing a data WAREHOUSE: why and how to build a data warehouse –data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse. Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson education, 2003.

2. C.S.R. Prabhu, "Data Warehousing Concepts, Techniques, Products and Applications", PHI, Third Edition, 2010.

Reference Books

1 Arun K. Pujari, "Data Mining Techniques", Universities Press (India) Pvt. Ltd., 2003.

2 Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", TMCH, 2001.

3 Jiawei Han & Micheline Kamber, Academic press. "Data Mining Concepts & Techniques", 2001,

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.javatpoint.com/data-warehouse

2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/

3.https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the basic data mining techniques and algorithms.	**K1, K2**
CO2	Understand the Association rules, Clustering techniques and Data warehousing contents.	**K2, K3**
CO3	Compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining.	**K4, K5**
CO4	Design data warehouse with dimensional modeling and apply OLAP operations.	**K5, K6**
CO5	Identify appropriate data mining algorithms to solve real world problems.	**K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Core – V	**Course Code:** 24PCS2C05		**Course Title:** Advanced Operating Systems	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	5	75	4	100

Course Objectives

The main objectives of this course are to:

1. Enable the students to learn the different types of operating systems and their functioning.
2. Gain knowledge on Distributed Operating Systems
3. Gain insight into the components and management aspects of real time and mobile operating systems.
4. Learn case studies in Linux Operating Systems

Unit:1 BASICS OF OPERATING SYSTEMS

Basics of Operating Systems: What is an Operating System? – Main frame Systems –Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention – Avoidance – Detection – Recovery.

Unit:2 DISTRIBUTED OPERATING SYSTEMS

Distributed Operating Systems: Issues – Communication Primitives – Lamport"s Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.

Unit:3 REAL TIME OPERATING SYSTEM

Realtime Operating Systems: Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling.

Unit:4 HANDHELD SYSTEM

Operating Systems for Handheld Systems: Requirements – Technology Overview –Handheld Operating Systems – PalmOS-Symbian Operating System- Android –Architecture of android – Securing handheld systems.

Unit:5 CASE STUDIES

Case Studies: Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.

2. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.

Reference Books

1. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.

2. Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.

3. Daniel.P.Bovet & Marco Cesati,"Understanding the Linux kernel",3rdedition,O"Reilly, 2005

4. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2. https://www.udacity.com/course/advanced-operating-systems--ud189
3. https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the design issues associated with operating systems.	**K1, K2**
CO2	Master various process management concepts including scheduling, deadlocks and distributed file systems.	**K3, K4**
CO3	Prepare Real Time Task Scheduling.	**K4, K5**
CO4	Analyze Operating Systems for Handheld Systems.	**K5**
CO5	Analyze Operating Systems like LINUX and iOS.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6- Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	M	S	S	S	S	S	M	S	M
CO3	S	M	S	S	S	S	S	M	S	M
CO4	S	M	S	S	S	S	S	M	S	M
CO5	S	M	S	S	S	S	S	M	S	M

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Core – VI	**Course Code:** 24PCS2C06		**Course Title:** Advanced Java Programming	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	5	75	4	100

Course Objectives

The main objectives of this course are to:

1. Enable the students to learn the basic functions, principles and concepts of advanced java programming.
2. Provide knowledge on concepts needed for distributed Application Architecture.
3. Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format.

Unit:1 BASICS OF JAVA

Java Basics Review: Components and event handling – Threading concepts – Networking features – Media techniques

Unit:2 REMOTE METHOD INVOCATION

Remote Method Invocation – Distributed Application Architecture – Creating stubs and skeletons Defining Remote objects – Remote Object Activation – Object Serialization – Java Spaces.

Unit:3 DATABASE

Java in Databases – JDBC principles – database access – Interacting – database search – Creating multimedia databases – Database support in web applications

Unit:4 SERVLETS

Java Servlets: Java Servlet and CGI programming – A simple java Servlet – Anatomy of a java Servlet – Reading data from a client – Reading http request header – sending data to a client and writing the http response header – working with cookies Java Server Pages: JSP Overview – Installation – JSP tags – Components of a JSP page – Expressions – Scriptlets – Directives – Declarations –A complete example.

Unit:5 ADVANCED TECHNIQUES

Socket Programming: Creating sockets, Posix data type, Socket addresses, Assigning address to a socket, Java socket programming, Berkeley Sockets: Overview, socket address structures - I/O asynchronous & multiplexing models, socket implementation (client & server programs), UNIX domain protocols. JAR file format creation – Internationalization – Swing Programming.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. Jamie Jaworski, "Java Unleashed", SAMS Techmedia Publications,1999.
2. Campione, Walrath and Huml, "The Java Tutorial", AddisonWesley,1999.

Reference Books

1. Jim Keogh," The Complete Reference J2EE", Tata McGrawHill Publishing Company Ltd,2010.
2. David Sawyer McFarland, "JavaScript and JQuery- The Missing Manual", Oreilly Publications, 3rd Edition, 2011.
3. Deitel and Deitel, "Java How to Program", Third Edition, PHI/Pearson Education Asia, 2001.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.javatpoint.com/servlet-tutorial
2. https://www.tutorialspoint.com/java/index.htm
3. https://onlinecourses.nptel.ac.in/noc19_cs84/preview

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the advanced concepts of Java Programming.	**K1, K2**
CO2	Understand JDBC and RMI concept.	**K2, K4**
CO3	Apply and analyze Java in Database.	**K3, K4**
CO4	Handle different event in java using the delegation event model, event listener and class.	**K5**
CO5	Design interactive applications using Java Servlet, JSP and JDBC.	**K5, K6**

K1 - Remember, K2 - Understand, K3 - Analyse, K4 - Implement, K5 -Evaluate, K6- Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Core Practical – III	**Course Code:** 24PCS2P03		**Course Title:** Data Mining Using R Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	4	100

Course Objectives

The main objectives of this course are to:

1. To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression.
2. To understand & write programs using the DM algorithms
3. To apply statistical interpretations for the solutions
4. Able to use visualizations techniques for interpretations

LIST OF PROGRAMS

1. Perform Data Pre-Processing Operations
    a) Handling Missing data
    b) Min - Max Normalization
2. Perform Dimensionality Reduction Operation using PCA.
3. Implement Apriori algorithm to extract association rule of datamining.
4. Implement k-means clustering technique.
5. Implement any one Hierarchal Clustering.
6. Implement Naïve bayes Classification.
7. Implement Decision Tree Classification.
8. Implement KNN Classification algorithm.
9. Implement Linear Regression.
10. Data Visualization.

Text Books

1. Margaret H. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson education, 2003.
2. C.S.R. Prabhu, “Data Warehousing Concepts, Techniques, Products and Applications”, PHI, Third Edition, 2010.

Reference Books

1 Arun K. Pujari, "Data Mining Techniques", Universities Press (India) Pvt. Ltd., 2003.

2 Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", TMCH, 2001.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.javatpoint.com/data-warehouse 30

2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/

3. https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Able to write programs using R for Association rules, Clustering techniques.	**K1, K2**
CO2	To implement data mining techniques like classification, prediction.	**K3, K4**
CO3	Able to use different visualizations techniques using R.	**K4, K5**
CO4	To apply different data mining algorithms to solve real world applications.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Core Practical – IV	**Course Code:** 24PCS2P04		**Course Title:** Advanced Java Programming Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	4	100

Course Objectives

The main objectives of this course are to:

1. To enable the students to implement the simple programs using JSP, JAR
2. To provide knowledge on using Servlets, Applets
3. To introduce JDBC and navigation of records
4. To understand RMI & its implementation
5. To introduce to Socket programming

LIST OF PROGRAMS

1. Display a welcome message using Servlet.
2. Design a Purchase Order form using Html form and Servlet.
3. Develop a program for calculating the percentage of marks of a student using JSP.
4. Design a Purchase Order form using Html form and JSP.
5. Prepare a Employee pay slip using JSP.
6. Write a program using JDBC for creating a table, Inserting, Deleting records and list out the records.
7. Write a program using Java servlet to handle form data.
8. Write a program in JSP by using session object.
9. Write a program to build a simple Client Server application using RMI.
10. Create an applet for a calculator application.
11. Program to send a text message to another system and receive the text message from the system (use socket programming).
12. Write an echo client and server program using Unix domain Datagram socket.

Text Books

1. Jamie Jaworski, “Java Unleashed”, SAMS Techmedia Publications, 1999.
2. Campione, Walrath and Huml, “The Java Tutorial”, AddisonWesley, 1999.

Reference Books

1. Jim Keogh,” The Complete Reference J2EE”, Tata McGrawHill Publishing Company Ltd, 2010.
2. David Sawyer McFarland, “JavaScript and JQuery - The Missing Manual”, Oreilly Publications, 3rd Edition, 2011.

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1. https://www.javatpoint.com/servlet-tutorial
2. https://www.tutorialspoint.com/java/index.htm
3. https://onlinecourses.nptel.ac.in/noc19_cs84/preview

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand to the implement concepts of Java using HTML forms, JSP & JAR.	**K1, K2**
CO2	Must be capable of implementing JDBC and RMI concepts.	**K3, K4**
CO3	Able to write Applets with Event handling mechanism.	**K4, K5**
CO4	To Create interactive web-based applications using servlets and JSP.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6- Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Common Course	**Course Code:** 24P2HR01		**Course Title:** Fundamentals of Human Rights	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	3	45	2	100

Unit-1: Introduction: Meaning and Definitions of Human Rights – Characteristics and Importance of Human Rights – Evolution of Human Rights – Formation, Structure and Functions of the UNO - Universal Declaration of Human Rights – International Covenants – Violations of Human Rights in the Contemporary Era.

Unit-2: Human Rights in India: Development of Human Rights in India – Constituent Assembly and Indian Constitution – Fundamental Rights and its Classification – Directive Principles of State Policy – Fundamental Duties.

Unit-3: Rights of Marginalized and other Disadvantaged People: Rights of Women – Rights of Children – Rights of Differently Abled – Rights of Elderly - Rights of Scheduled Castes – Rights of Scheduled Tribes – Rights of Minorities – Rights of Prisoners – Rights of Persons Living with HIVAIDS – Rights of LGBT.

Unit-4: Human Rights Movements: Peasant Movements (Tebhaga and Telangana) – Scheduled Caste Movements (Mahar and Ad-Dharmi) – Scheduled Tribes Movements (Santhal and Munda) – Environmental Movements (Chipko and Narmada BachaoAndolan) – Social Reform Movements (Vaikom and Self Respect).

Unit-5: Redressal Mechanisms: Protection of Human Rights Act, 1993 (Amendment 2019) – Structure and Functions of National and State Human Rights Commissions – National Commission for SCs – National Commission for STs – National Commission for Women – National Commission for Minorities – Characteristics and Objectives of Human Rights Education.

Text and Reference Books

1. Sudarshanam Gankidi, Human Rights in India: Prospective and Retrospective, Rawat Publications, Jaipur, 2019.
2. SatvinderJuss, Human Rights in India, Routledge, New Delhi, 2020.
3. Namita Gupta, Social Justice and Human Rights in India, Rawat Publications, Jaipur, 2021.

4. Mark Frezo, The Sociology of Human Rights, John Willy & Sons, U.K. 2014.

5. Chiranjivi J. Nirmal, Human Rights in India: Historical, Social and Political Perspectives, Oxford University Press, New York, 2000.

6. Dr. S. Mehartaj Begum, Human Rights in India: Issues and perspectives, APH Publishing Corporation, New Delhi, 2010.

7. Asha Kiran, The History of Human Rights, Mangalam Publications, Delhi, 2011.

8. Bani Borgohain, Human Rights, Kanishka Publishers & Distributors, New Delhi-2, 2007.

9. Jayant Chudhary, A Textbook of Human Rights, Wisdom Press, New Delhi, 2011.

Program: M.Sc Computer Science				
Core – VII	**Course Code:** 24PCS3C07		**Course Title:** Digital Image Processing	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	6	90	5	100

Course Objectives

The main objectives of this course are to:

1. Learn basic image processing techniques for solving real problems.
2. Gain knowledge in image transformation and Image enhancement techniques.
3. Learn Image compression and Segmentation procedures.

Unit:1 INTRODUCTION

Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.

Unit:2 IMAGE ENHANCEMENT

Image Enhancement in the spatial domain: - Background – some basic Gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.

Unit:3 IMAGE RESTORATION

Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.

Unit:4 IMAGE COMPRESSION

Image Compression: Fundamentals – Image compression models – Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards.

Unit:5 IMAGE SEGMENTATION

Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars.

Text Books

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Third Edition, PHI/Pearson Education, 2009.

2. B. Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2003.

Reference Books

1. Nick Efford, "Digital Image Processing a practical introducing using Java", Pearson Education, 2004.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/117/105/117105135/
2. https://www.tutorialspoint.com/dip/index.htm
3. https://www.javatpoint.com/digital-image-processing-tutorial.

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the fundamentals of Digital Image Processing	**K1, K2**
CO2	Understand the mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement.	**K2, K3**
CO3	Apply, Design and Implement and get solutions for digital image processing problems.	**K3, K4**
CO4	Apply the concepts of filtering and segmentation for digital image retrieval.	**K4, K5**
CO5	Explore the concepts of Multi-resolution process and recognize the objects in an efficient manner	**K5, K6**

K1 - Remember, K2 - Understand, K3 - Analyse , K4 - Implement, K5 -Evaluate, K6- Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	M	S	M	M	S
CO2	S	S	S	S	S	M	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – L**

Program: M.Sc Computer Science				
Core – VIII	**Course Code:** 24PCS3C08		**Course Title:** Cloud Computing	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	5	75	5	100

Course Objectives

The main objectives of this course are to:

1. Gain knowledge on cloud computing, cloud services, architectures and applications.
2. Enable the students to learn the basics of cloud computing with real time usage
3. How to store and share, in and from cloud?

Unit:1 INTRODUCTION

Cloud Computing Introduction, From, Collaboration to cloud, Working of cloud computing, pros and cons, benefits, developing cloud computing services, Cloud service development, discovering cloud services.

Unit:2 CLOUD COMPUTING FOR EVERYONE

Centralizing email communications, cloud computing for community, collaborating on schedules, collaborating on group projects and events, cloud computing for corporation, mapping, schedules, managing projects, presenting on road.

Unit:3 CLOUD SERVICES

Collaborating on calendars, Schedules and task management, exploring on line scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets, and databases.

Unit:4 OUTSIDE THE CLOUD

Evaluating web mail services, Evaluating instant messaging, Evaluating web conference tools, creating groups on social networks, Evaluating on line groupware, collaborating via blogs and wikis.

Unit:5 STORING AND SHARING

Understanding cloud storage, evaluating on line file storage, exploring on-line book-marking services, exploring on line photo editing applications, exploring photo sharing communities,

controlling it with web-based desktops.

Unit:6 Contemporary Issues Expert lectures, online seminars – webinars.

Text Books

1. Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2009.

Reference Books

1 Anthony T. Velte, "Cloud Computing: A Practical Approach", 1st Edition, Tata McGraw Hill Education Private Limited, 2009.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. https://www.javatpoint.com/cloud-computing-tutorial

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the concepts of Cloud and its services.	**K1, K2**
CO2	Collaborate Cloud for Event & Project Management.	**K3, K4**
CO3	Analyze on cloud in – Word Processing, Spread Sheets, Mail, Calendar, Database.	**K4, K5**
CO4	Analyze cloud in social networks.	**K5, K6**
CO5	Explore cloud storage and sharing.	**K6**

K1 - Remember, K2 - Understand, K3 - Analyse, K4 - Implement, K5 -Evaluate, K6- Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	M	S	M	M	S
CO2	S	S	S	S	S	M	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Core – IX	**Course Code:** 24PCS3C09		**Course Title:** Network Security and Cryptography	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	5	75	5	100

Course Objectives

The main objectives of this course are to:

1. Enable students to learn the Introduction to Cryptography, Web Security and Case studies in Cryptography.
2. To gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory.
3. To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms.
4. To explore the design issues and working principles of various authentication Applications and various secure communication standards including Kerberos, IPsec, and SSL/TLS and email.

Unit:1 INTRODUCTION

Introduction to Cryptography – Security Attacks – Security Services – Security Algorithm – Stream cipher and Block cipher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.

Unit:2 CRYPTO SYSTEM

Public-key Cryptosystem: Introduction to Number Theory – RSA Algorithm – Key Management – Diffie-Hell man Key exchange – Elliptic Curve Cryptography Message Authentication and Hash functions – Hash and Mac Algorithm – Digital Signatures and Authentication Protocol.

Unit:3 NETWORK SECURITY

Network Security Practice: Authentication Applications – Kerberos – X.509 Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.

Unit:4 WEB SECURITY

Web Security - Secure Socket Layer – Secure Electronic Transaction. System Security –Intruders

and Viruses – Firewalls – Password Security.

Unit:5 CASE STUDY

Case Study: Implementation of Cryptographic Algorithms – RSA – DSA – ECC (C / JAVA Programming). Network Forensic – Security Audit - Other Security Mechanism: Introduction to: Stenography – Quantum Cryptography – Water Marking - DNA Cryptography

Unit:6 Contemporary Issues Expert lectures, online seminars – webinars

Text Books

1. William Stallings, "Cryptography and Network Security", PHI/Pearson Education, Fourth Edition, 2005.
2. Bruce Schneir, "Applied Cryptography: Protocols, Algorithms, and Source Code in C", CRC Press, 1995.

Reference Books

1. A.Menezes, P Van Oorschot and S.Vanstone, "Hand Book ofApplied Cryptography", CRC Press, 1997
2. AnkitFadia,"Network Security: A Hacker's Perspective", MacMillan, Course Technology Inc, 2006.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/106/105/106105031/
2. http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html
3. https://www.tutorialspoint.com/cryptography/index.html

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the process of the cryptographic algorithms.	**K1, K2**
CO2	Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.	**K2, K3**
CO3	Apply and analyze appropriate security techniques to solve network security problem.	**K3, K4**
CO4	Explore suitable cryptographic algorithms.	**K4, K5**
CO5	Analyze different digital signature algorithms to achieve authentication and design secure applications.	**K5, K6**

K1 - Remember, K2 - Understand, K3 - Analyse, K4 - Implement, K5 -Evaluate, K6- Create

Mapping of COs with Pos

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	L	S	M	S	M	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Core – X	**Course Code:** 24PCS3C10		**Course Title:** Data Science & Analytics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	6	90	4	100

Course Objectives

The main objectives of this course are to:

1. Introduce the students to data science, big data & its eco system.
2. Learn data analytics & its life cycle.
3. To explore the programming language R, with respect to the data mining algorithms.
4. Relate the relationship between artificial intelligence, machine learning and data science.

Unit:1 INTRODUCTION

Introduction of Data Science: data science and big data – facets of data – data science process Ecosystem – The Data Science process – six steps – Machine Learning.

Unit:2 BASICS OF DATA ANALYTICS

Data Analytics life cycle – review of data analytics – Advanced data Analytics – technology and tools.

Unit:3 DATA ANALYTICS USING R

Basic Data Analytics using R: R Graphical User Interfaces – Data Import and Export – Attribute and Data Types –Descriptive Statistics – Exploratory Data Analysis –Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.

Unit:4 CLUSTERING

Overview of Clustering: K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R –Classification – Decision Trees – Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes‟ Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.

Unit:5 ARTIFICIAL INTELLIGENCE

Artificial intelligence: Machine Learning and deep learning in data science - Clustering, association rules. Linear regression-logistic regression-Additional regression methods.

Unit:6 Contemporary Issues Expert lectures, online seminars – webinars

Text Books

1.Introducing-Data-Science-Big-Data-Machine-Learning-and-more-using-Python-tools-2016. Pdf.

2. Data science in big data analytics-Wiley John Wiley & Sons, 2015.

Reference Books

1. A simple introduction to Data Science - Lars Nielson, 2015

2. Introducing Data Science Davy Cielen, Arno D.B.Meysman, Mohamed Ali, Manning Publication, 2016.

3. R Programming for Data Science - Roger D.Peng, Lean Publication, 2015.

4. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, 2015.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.tutorialspoint.com/python_data_science/index.htm
2. https://www.javatpoint.com/data-science
3. https://nptel.ac.in/courses/106/106/106106179/

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the concept of data science and its techniques.	**K1, K2**
CO2	Review data analytics.	**K2, K3**
CO3	Apply and determine appropriate Data Mining techniques using R to real time applications.	**K3, K4**
CO4	Analyze on clustering algorithms.	**K4, K5**
CO5	Analyze on regression methods in AI.	**K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong,** **M – Medium,** **L – Low**

Program: M.Sc Computer Science				
Core Practical – V	**Course Code:** 24PCS3P05		**Course Title:** Digital Image Processing Using MATLAB	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	3	45	3	100

Course Objectives

The main objectives of this course are to:

1. To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques.
2. To enable the students to learn the fundamentals of image compression and segmentation.
3. To understand Image Restoration & Filtering Techniques.
4. Implementation of the above using MATLAB.

LIST OF PROGRAMS

SIMULATION USING MATLAB

1. Image enhancement Technique.
2. Histogram Equalization.
3. Image Restoration.
4. Image Filtering.
5. Histogram Processing and Basic Thresholding functions.
6. Region based Segmentation
7. Image compression techniques.
8. Boundary Extraction using morphology.
9. Segmentation using watershed transformation
10. Analysis of images with different color models.

Text Books

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Fourth Edition, PHI/Pearson Education, 2018.

2. B. Chanda, D. Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2003.

Reference Books

1. Nick Efford, "Digital Image Processing a practical introducing using Java", Pearson Education, 2004.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/117/105/117105135/
2. https://www.tutorialspoint.com/dip/index.htm
3. https://www.javatpoint.com/digital-image-processing-tutorial

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	To write programs in MATLAB for image processing using the techniques.	**K1, K2**
CO2	To able to implement Image Enhancements & Restoration techniques.	**K2, K3**
CO3	Capable of using Compression techniques in an Image.	**K3, K4**
CO4	Must be able to manipulate the image and Segment it.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6- Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Core Practical – VI	**Course Code:** 24PCS3P06		**Course Title:** Cloud Computing Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	3	45	2	100

Course Objectives

The main objectives of this course are to:

1. To understand the basics of Cloud computing techniques.
2. To enable the students to learn about exploring Google cloud.
3. To understand Google App Engine and Microsoft Azure.

LIST OF PROGRAMS

1. Working with Google Drive to make spreadsheet and notes.
2. Launch a Linux Virtual Machine.
3. To host a static website.
4. Exploring Google cloud for the following

a) Storage b) Sharing of data c) manage your calendar, to-do lists, d) a document editing tool

5. Working and installation of Google App Engine.
6. Working and installation of Microsoft Azure.
7. To Create and Query a NoSQL Table.
8. Install Hadoop single node cluster and run simple applications like wordcount.
9. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
10. Find a procedure to transfer the files from one virtual machine to another virtual machine.

Text Books

1. Michael Miller, “Cloud Computing”, Pearson Education, New Delhi, 2009.

Reference Books

1. Anthony T. Velte, “Cloud Computing: A Practical Approach”, 1st Edition, Tata McGraw Hill Education Private Limited, 2009.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. https://www.javatpoint.com/cloud-computing-tutorial

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	To write programs in cloud computing for exploring Google Cloud.	**K1, K2**
CO2	To able to implement Google App Engine and Microsoft Azuare.	**K3, K4**
CO3	Capable of using Cloud computing techniques.	**K3, K4**
CO4	Must be able to Create queries and manipulate the NoSQL Table.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6- Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Core Practical – VII	**Course Code:** 24PCS4P07		**Course Title:** Web Application Development and Hosting Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	5	75	5	100

Course Objectives

The main objectives of this course are to:

1. Able to design a web page using HTML tags.
2. To enable the students to use Framesets, hyper links and different formatting features of HTML tags.
3. Enable the students to use Forms & other controls in a web page.
4. To create interactive applications using PHP.

LIST OF PROGRAMS

1. Develop a website for your college using advanced tags of HTML.
2. Develop a HTML document to display a Registration Form for an inter-collegiate function.
3. Using HTML form accept Customer details like Name, City, Pin code, Phone number and Email address and validate the data and display appropriate messages for violations using PHP (Eg. Name is Mandatory field; Pin code must be 6 digits, etc.).
4. Develop a login and registration form using PHP with MySQL.
5. Develop a PHP Application to show all records available on Student Table.
6. Develop a simple application to Update, Delete table data from database using PHP.
7. Create a web page to advertise a product of the company using images and audio using PHP.
8. Write a Javascript program to validate USER LOGIN page.
9. Write a Javascript program for validating REGISTRATION FORM.
10. Write a JavaScript Program for age validation

Text Books

1. Ivan Bayross, "Web Enabled Commercial Applications Development Using HTML, JavaScript, DHTML and PHP", BPB Publications, 4th Revised Edition, 2010.

Reference Books

1. A.K.Saini and SumintTuli, "Mastering XML", First Edition, New Delhi, 2002.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.tutorialspoint.com/xml/index.htm
2. https://www.tutorialspoint.com/internet_technologies/websites_development.htm
3. https://www.youtube.com/watch?v=PlxWf493en4

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand & implement the basic HTML tags to create static web pages	**K1, K2**
CO2	Capable of using hyperlinks, frames, images, tables in a web page.	**K2, K3**
CO3	Able to write dynamic web applications using HTML forms	**K4, K5**
CO4	Must be able to write dynamic web applications in PHP & HTML tags using XAMPP.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6- Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – Low**

ELECTIVE COURSES

Program: M.Sc Computer Science				
Elective – I	**Course Code:** 24PCS1E01		**Course Title:** Advanced Software Engineering	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	3	100

Course Objectives

The main objectives of this course are to:

1. Introduce to Software Engineering, Design, Testing and Maintenance.
2. Enable the students to learn the concepts of Software Engineering.
3. Learn about Software Project Management, Software Design & Testing.

Unit:1 INTRODUCTION

Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.

Unit:2 SOFTWARE REQUIREMENTS

Software Requirements Analysis and Specification: Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Result management system. Software Quality Management – Software Quality, Software Quality Management System, ISO 9000, SEI CMM.

Unit:3 PROJECT MANAGEMENT

Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead"s software science – Staffing level estimation – Scheduling – Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.

Unit:4 SOFTWARE DESIGN

Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.

Unit:5 SOFTWARE TESTING

Software Testing: A Strategic approach to software testing – Terminologies – Functional testing – Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging – Testing tools - Metrics-Reliability Estimation. Software Maintenance - Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.

Unit:6 Contemporary Issues Expert lectures, online seminars – webinars

Text Books

1. An Integrated Approach to Software Engineering – Pankaj Jalote, Narosa Publishing House, Delhi, 3rd Edition, 2005.
2. Fundamentals of Software Engineering – Rajib Mall, PHI Publication, 3rd Edition, 2009.

Reference Books

1. Software Engineering – K.K. Aggarwal and Yogesh Singh, New Age International Publishers, 3rd edition, 2007.
2. A Practitioners Approach- Software Engineering, - R. S. Pressman, McGraw Hill, 7th Edition, 2009. .
3. Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D. Manodrioli, PHI Publication, 2nd Edition, 2007.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.javatpoint.com/software-engineering-tutorial
2. https://onlinecourses.swayam2.ac.in/cec20_cs07/preview
3. https://onlinecourses.nptel.ac.in/noc19_cs69/preview

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand about Software Engineering process.	**K1, K2**
CO2	Understand about Software project management skills, design and quality management.	**K2, K3**
CO3	Analyze on Software Requirements and Specification.	**K3, K4**
CO4	Analyze on Software Testing, Maintenance and Software Re-Engineering.	**K4, K5**
CO5	Design and conduct various types and levels of software quality for a software project.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong,** **M – Medium,** **L – Low**

Program: M.Sc Computer Science				
Elective – I	**Course Code:** 24PCS1E02		**Course Title:** Multimedia and Its Applications	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	3	100

Course Objectives

The main objectives of this course are to:

1. To introduce the students the concepts of Multimedia, Images & Animation.
2. To introduce Multimedia authoring tools
3. To understand the role of Multimedia in Internet
4. To know about High Definition Television and Desktop Computing – Knowledge based Multimedia systems

Unit:1 INTRODUCTION

What is Multimedia? – Introduction to making Multimedia – Macintosh and Windows Production platforms – Basic Software tools.

Unit:2 MULTIMEDIA TOOLS

Making Instant Multimedia – Multimedia authoring tools – Multimedia building blocks – Text – Sound.

Unit:3 ANIMATION

Images – Animation – Video.

Unit:4 INTERNET

Multimedia and the Internet – The Internet and how it works – Tools for World Wide Web – Designing for the World Wide Web.

Unit:5 MULTIMEDIA SYSTEMS

High Definition Television and Desktop Computing – Knowledge based Multimedia systems.

Unit:6

Contemporary Issues Expert lectures, online seminars – webinars

Text Books

1. Tay Vaughan, "Multimedia making it work", Fifth Edition, Tata McGrawHill, 2001.
2. John F. Koegel Bufford, "Multimedia Systems", Pearson Education, First Edition, 2002.

Reference Books

1. Judith Jeffloate, "Multimedia in Practice (Technology and Applications)", PHI, 2003.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.tutorialspoint.com/multimedia/index.htm
2.https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_m ultimedia.htm
3. https://nptel.ac.in/courses/117/105/117105083/

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the basic concepts of Multimedia.	**K1, K2**
CO2	Demonstrate Multimedia authoring tools.	**K2, K3**
CO3	Analyze the concepts of Sound, Images, Video & Animation.	**K4**
CO4	Apply and Analyze the role of Multimedia in Internet and real time applications.	**K4, K5**
CO5	Analyze multimedia applications using HDTV.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	M	M	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Elective – I	**Course Code:** 24PCS1E03		**Course Title:** Embedded Systems	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	3	100

Course Objectives

The main objectives of this course are to:

1. Present the introduction to 8051 Microcontroller Instruction Set, concepts on RTOS & Software tools.
2. Gain the knowledge about the embedded software development.
3. Learn about Microcontroller and software tools in the embedded systems.

Unit:1 8051 MICROCONTROLLER

8051 Microcontroller: Introduction - 8051 Architecture-Input/Output Pins, Ports and Circuits - External Memory - Counters / Timers - Serial Data Input / Output –Interrupts

Unit:2 PROGRAMMING BASICS

Instruction Set and Programming Moving Data-Addressing Modes-Logical operations-Arithmetic Operation-Jump and Call Instructions-Simple Program. Applications: Keyboard Interface- Display Interface-Pulse Measurements-DIA and AID Conversions-Multiple Interrupts.

Unit:3 CONCEPTS ON RTOS

Introduction to RTOS-Selecting an RTOS-Task and Task states - Tasks and data-Semaphores and shared data. MORE operating systems services: Interrupt Process communication - Message Queues, Mailboxes and pipes- Timer Functions-Events - Memory Management-Interrupt Routines in an RTOS Environment.

Unit:4 DESIGN USING RTOS

Basic Design using a RTOS: Principles - Encapsulating semaphores and Queues-Hard real time scheduling considerations-Saving memory space and power- introductions to RTL &QNX.

Unit:5 SOFTWARE TOOLS

Embedded software Development Tools: Hosts and Target Machines - Linker/Locators for Embedded software-getting Embedded software into the Target systems. Debugging Techniques: Testing on your Host machine -Instruction set simulators- The assert macro-using laboratory tools.

Unit:6 Contemporary Issues Expert lectures, online seminars – webinars

Text Books

1. David E. Simon, "An Embedded Software primer" Pearson Education Asia, 2003.
2. Kenneth J Ayala, "The 8051 Microcontroller and Architecture programming and application", Second Edition, Penram International.

Reference Books

1. Raj Kamal, "Embedded Systems – Architecture, programming and design", Tata McGraw – Hill, 2003.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://onlinecourses.nptel.ac.in/noc20_cs14/preview
2. https://www.javatpoint.com/embedded-system-tutorial
3. https://www.tutorialspoint.com/embedded_systems/index.htm

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the concept of 8051 microcontroller.	**K1, K2**
CO2	Understand the Instruction Set and Programming.	**K2, K3**
CO3	Analyze the concepts of RTOS.	**K3, K4**
CO4	Analyze and design various real time embedded systems using RTOS.	**K5**
CO5	Debug the malfunctioning system using various debugging techniques.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	S	M	S	S	M	M	S
CO2	M	M	S	S	M	S	M	S	S	S
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Elective – II	**Course Code:** 24PCS2E04		**Course Title:** Artificial Intelligence and Machine Learning	
Semester II	**Hours/Week** 4	**Total Hours** 60	**Credits** 3	**Total Marks** 100

Course Objectives

The main objectives of this course are to:

1. Enable the students to learn the basic functions of AI, Heuristic Search Techniques.
2. Provide knowledge on concepts of Representations and Mappings and Predicate Logic.
3. Introduce Machine Learning with respect Data Mining, Big Data and Cloud.
4. Study about Applications & Impact of ML.

Unit:1 INTRODUCTION

Introduction: AI Problems - Al techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.

Unit:2 SEARCH TECHNIQUES

Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.

Unit:3 PREDICATE LOGIC

Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledge using rules: Procedural Vs Declarative knowledge - Logic programming - Forward Vs Backward reasoning - Matching - Control knowledge.

Unit:4 MACHINE LEARNING

Understanding Machine Learning: What Is Machine Learning? - Defining Big Data-Big Data in Context with Machine Learning-The Importance of the Hybrid Cloud-Leveraging the

Power of Machine Learning-The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.

Unit:5 APPLICATIONS OF MACHINE LEARNING

Looking Inside Machine Learning: The Impact of Machine Learning on Applications - Data Preparation-The Machine Learning Cycle.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. Elaine Rich and Kevin Knight," Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Second Edition, 1991.
2. George F Luger, "Artificial Intelligence", 4th Edition, Pearson Education Publication, 2002.

Reference Books

1. Machine Learning for Dummies, IBM Limited Edition by Judith Hurwitz, Daniel Kirsch.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.ibm.com/downloads/cas/GB8ZMQZ3
2. https://www.javatpoint.com/artificial-intelligence-tutorial
3. https://nptel.ac.in/courses/106/105/106105077/

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Demonstrate AI problems and techniques.	**K1, K2**
CO2	Understand machine learning concepts.	**K2, K3**
CO3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	**K3, K4**
CO4	Analyze the impact of machine learning on applications.	**K4, K5**
CO5	Analyze and design a real-world problem for implementation and understand the dynamic behavior of a system.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong,** **M – Medium,** **L – Low**

Program: M.Sc Computer Science				
Elective – II	**Course Code:** 24PCS2E05		**Course Title:** Internet of Things	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	3	100

Course Objectives

The main objectives of this course are to:

1. About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.
2. Enable students to learn the Architecture of IoT and IoT Technologies
3. Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE, Sensors and Actuators Programming NODEMCU using Arduino IDE.

Unit:1 INTRODUCTION

Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT – Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT.

Unit:2 BASIC ELECTRONICS FOR IoT

Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation**.**

Unit:3 PROGRAMMING USING ARDUINO

Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.

Unit:4 SENSORS AND ACTUATORS

Analog and Digital Sensors – Interfacing temperature sensor, ultrasound sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.

Unit:5 SENSOR DATA IN INTERNET

Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (ThingSpeak).

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach", 2014. ISBN: 978-0996025515

2. Boris Adryan, Dominik Obermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech Houser Publishers, 2017.

Reference Books

1. Michael Margolis, "Arduino Cookbook", O"Reilly, 2011

2. Marco Schwartz, "Internet of Things with ESP8266", Packt Publishing, 2016.

3. Dhivya Bala, "ESP8266: Step by Step Tutorial for ESP8266 IoT, Arduino NODEMCU Dev. Kit", 2018.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2. https://www.javatpoint.com/iot-internet-of-things
3. https://www.tutorialspoint.com/internet_of_things/index.htm

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand about IoT, its Architecture and its Applications.	**K1, K2**
CO2	Understand basic electronics used in IoT & its role.	**K2, K3**
CO3	Develop applications with C using Arduino IDE.	**K4**
CO4	Analyze about sensors and actuators.	**K5, K6**
CO5	Design IoT in real time applications using today's internet & wireless technologies.	**K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	M	S	S	M	S	M
CO2	M	S	M	S	M	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

***S – Strong,** **M – Medium,** **L – Low**

Program: M.Sc Computer Science				
Elective – II	**Course Code:** 24PCS2E06		**Course Title:** Mobile Computing	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	3	100

Course Objectives

The main objectives of this course are to:

1. Present the overview of Mobile computing, Applications and Architectures.
2. Describe the futuristic computing challenges.
3. Enable the students to learn the concept of mobile computing.

Unit:1 INTRODUCTION

Introduction: Advantages of Digital Information - Introduction to Telephone Systems – Mobile communication: Need for Mobile Communication – Requirements of Mobile Communication – History of Mobile Communication.

Unit:2 MOBILE COMMUNICATION

Introduction to Cellular Mobile Communication – Mobile Communication Standards – Mobility Management – Frequency Management – Cordless Mobile Communication Systems.

Unit:3 MOBILE COMPUTING

Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Changeover from one satellite to other – Global Mobile Communication – Interferences in Cellular Mobile Communication.

Unit:4 MOBILE COMMUNICATION SYSTEM

Important Parameters of Mobile Communication System – Mobile Internet: Working of Mobile IP – Wireless Network Security – Wireless Local Loop Architecture: Components in

WLL – Problems in WLL – Modern Wireless Local Loop – Local Multipoint Distribution Service – Wireless Application Protocol.

Unit:5 COMMUNICATION TECHNOLOGY

WCDMA Technology and Fiber Optic Microcellular Mobile Communication – Ad hoc Network and Bluetooth technology – Intelligent Mobile Communication system – Fourth Generation Mobile Communication systems.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. T.G. Palanivelu, R. Nakkeeran, "Wireless and Mobile Communication", PHI Limited, 2009.

2. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2007.

Reference Books

1. Asoke K Talukder, Hasan Ahmed, Roopa Yavagal, "Mobile Computing",TMH, 2010.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.tutorialspoint.com/mobile_computing/index.htm

2.https://www.javatpoint.com/mobile-computing

3. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the need and requirements of mobile communication	**K1, K2**
CO2	Focus on mobile computing applications and techniques.	**K2, K3**
CO3	Demonstrate satellite communication in mobile computing.	**K4**
CO4	Analyze about wireless local loop architecture.	**K5, K6**
CO5	Analyze various mobile communication technologies.	**K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	L	L	M	S	M	M	M	M
CO2	S	S	S	M	M	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
Elective – II		**Course Code:** 24PCS4E07		**Course Title:** Critical Thinking, Design Thinking and Problem Solving
Semester IV	**Hours/Week** 4	**Total Hours** 60	**Credits** 3	**Total Marks** 100

Course Objectives

The main objectives of this course are to:

1. Learn critical thinking and its related concepts
2. Learn design thinking and its related concepts
3. Develop Thinking patterns, Problem solving & Reasoning.

Unit:1 CRITICAL THINKING

Critical Thinking: Definition, Conclusions and Decisions, Beliefs and Claims, Evidence – finding, evaluation, Inferences, Facts – opinion, probable truth, probably false, Venn diagram. Applied critical thinking: Inference, Explanation, Evidence, Credibility, Two Case Studies, critical thinking and science, critical evaluation, self-assessment.

Unit:2 DESIGN THINKING

Design Thinking: Introduction, Need of Design Thinking, problem to question - design thinking process, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, problem exploration, Stake holder assessment, design thinking for manufacturers, smart Idea to implementation.

Unit:3 CASE STUDY

Thinking to confidence, fear management, duty Vs passion, Team management, Tools for Thinking, prototype design, Relevance of Design and Design Thinking in engineering, human centered design, case study: apply design thinking in problem.

Unit:4 PROBLEM SOLVING

Problem solving: problem definition, problem solving methods, selecting and using information, data processing, solution methods, solving problems by searching, recognizing

patterns, spatial reasoning, necessity and sufficiency, choosing and using models, making choices and decisions.

Unit:5 REASONING

Reasoning: Deductive and hypothetical reasoning, computational problem solving; generating, implementing, and evaluating solutions, interpersonal problem solving. Advanced problem solving: Combining skills – using imagination, developing models, Carrying out investigations, Data analysis and inference. Graphical methods of solution, Probability, tree diagrams and decision trees

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. John Butterworth and Geoff Thwaites, Thinking skills: Critical Thinking and Problem Solving, Cambridge University Press, 2013.

2. H. S. Fogler and S. E. LeBlanc, Strategies for Creative Problem Solving, 2nd edition, Pearson, Upper Saddle River, NJ, 2008.

Reference Books

1. A. Whimbey and J. Lochhead, Problem Solving & Comprehension, 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999.

2. M. Levine, Effective Problem Solving, 2nd edition, Prentice Hall, Upper Saddle River, NJ, 1994.

3. Michael Baker, The Basic of Critical Thinking, The Critical Thinking Co press, 2015.

4. David Kelley and Tom Kelley, Creative Confidence, 2013.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.tutorialspoint.com/critical_thinking/index.htm
2. https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm
3. https://nptel.ac.in/courses/109/104/109104109/

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the concepts of Critical thinking and its related technology.	**K1, K2**
CO2	Focus on the explicit development of critical thinking and problem-solving skills.	**K2, K3**
CO3	Apply design thinking in problems.	**K3, K4**
CO4	Make a decision and take actions based on analysis.	**K4, K5**
CO5	Analyze the concepts of Thinking patterns, Problem solving & Reasoning in real time applications.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	M	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

***S – Strong,** **M – Medium,** **L – Low**

Program: M.Sc Computer Science				
Elective – II	**Course Code:** 24PCS4E08		**Course Title:** Web Services	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	4	60	3	100

Course Objectives

The main objectives of this course are to:

1. Present the Web Services, building real world Enterprise applications using Web Services with Technologies XML, SOAP, WSDL, UDDI
2. Get overview of Distributed Computing, XML, and its technologies
3. Update with QoS and its features
4. Develop Standards and future of Web Services

Unit:1 INTRODUCTION

Introduction to web services – Overview of Distributed Computing- Evolution and importance of web services-Industry standards, Technologies and concepts underlying web services-Web services and enterprises-web services standards organization-web services platforms.

Unit:2 XML FUNDAMENTALS

XML Fundamentals – XML documents - XML Namespaces- XML Schema –Processing XML.

Unit:3 SOAP MODEL

SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure-interface definitions-bindings-services-Using SOAP and WSDL-UDDI: About UDDI- UDDI registry Specification- Core data structures-Accessing UDDI

Unit:4 TECHNOLOGIES AND STANDARDS

Advanced web services technologies and standards: Conversations overview-web services conversation language-WSCL interface components. Workflow: business process

management - workflows and workflow management systems Security: Basics-data handling and forwarding- data storage-errors-Web services security issues.

Unit:5 QUALITY OF SERVICE

Quality of Service: Importance of QoS for web services - QoS metrics – holes - design patterns - QoS enabled web services - QoS enabled applications. Web services management - web services standards and future trends.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services: An Architects Guide”, Prentice Hall, Nov 2003.

2. Keith Ballinger, “NET Web services: Architecture and Implementation with .Net”, Pearson Education, First Edition, Feb 2003.

Reference Books

1. Ramesh Nagappan, “Developing Java Web Services: Architecting and developing secure Web Services Using Java”, John Wiley and Sons, first Edition Feb 2003.

2. Eric A Marks and Mark J Werrell, “Executive Guide to Web services”, John Wiley and sons, March 2003.

3. Anne Thomas Manes, “Web Services: A managers Guide”, Addison Wesley, June 2003.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.tutorialspoint.com/webservices/index.htm

2. https://www.javatpoint.com/web-services-tutorial

3.https://www.btechguru.com/training--programming--xml--web-services--web-services-part- 1-video-lecture--11801--24--147.html

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand web services and its related technologies.	**K1, K2**
CO2	Understand XML concepts.	**K2, K3**
CO3	Analyze on SOAP and UDDI model.	**K4, K5**
CO4	Demonstrate the road map for the standards and future of web services.	**K5**
CO5	Analyze QoS enabled applications in web services.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	S	M	M	M	S
CO2	S	S	S	M	M	S	M	S	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

***S – Strong,** **M – Medium,** **L – Low**

Program: M.Sc Computer Science				
Elective – II	**Course Code:** 24PCS4E09		**Course Title:** Robotic Process Automation for Business	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	4	60	3	100

Course Objectives

The main objectives of this course are to:

1. Learn the concepts of RPA, its benefits, types and models.
2. Gain the knowledge in application of RPA in Business Scenarios.
3. Identify measures and skills required for RPA.

Unit:1 INTRODUCTION

Introduction to RPA - Overview of RPA - Benefits of RPA in a business environment - Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementing RPA - Centre of Excellence – Types and their applications - Building an RPA team - Approach for implementing RPA initiatives.

Unit:2 AUTOMATION

Role of a Business Manager in Automation initiatives - Skills required by a Business Manager for successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people.

Unit:3 AUTOMATION IMPLEMENTATION

Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows.

Unit:4 ROBOT

Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behavior - Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.

Unit:5 ROBOT SKILL

Inference from snapshots of curated terms – Omni-source data curation - Multisource trend tracking - Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Books

1. Alok Mani Tripathi" Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool" Packt Publishing Limited March 2018.

2. Tom Taulli "The Robotic Process Automation Handbook" Apress , February 2020.

Reference Books

1. Steve Kaelble" Robotic Process Automation" John Wiley & Sons, Ltd., 2018

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1.https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.htm

2. https://www.javatpoint.com/rpa

3. https://onlinecourses.nptel.ac.in/noc19_me74/preview

Expected Course Outcomes

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Demonstrate the benefits and ethics of RPA.	**K1, K2**
CO2	Understand the Automation cycle and its techniques.	**K2**
CO3	Draw inferences and information processing of RPA.	**K3, K4**
CO4	Implement & Apply RPA in Business Scenarios.	**K5**
CO5	Analyze on Robots & leveraging automation.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong,** **M – Medium,** **L – Low**

NME-NON-MAJOR ELECTIVE

List of Non-Major Electives offered by the Department of Computer Science for other PG Programmes

Program: M.Sc Computer Science				
NME	**Course Code:** 24PCS2N01		**Course Title:** Principles of Information Technology	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	4	100

Course Objectives

The main objectives of this course are to:

1. To learn the basic concept and skills associated with information technology
2. To know the Computer hardware and software technologies
3. To gain the knowledge of organizing data
4. To assess the current role of Information Science in an organization
5. To understand how IT relates to organizational goals.

Unit:1

Business Environment: Business and Information Technology – Business in the Information Age – about Information Technology – what is an Information System – Information Technology in the Modern Organization.

Unit:2

Computer Hardware – Significance of Hardware – Central Processing Unit – Computer Memory – Computer Hierarchy – Input Technologies – Output Technologies – Strategic Hardware Issues. Computer Software: Software History and Significance – System Software – Application Software – Software Issues – Programming Languages – Enterprise Software.

Unit:3

Managing Organizational Data and Information: Basics of Data Arrangement and Access – Traditional File Environment – Modern Approach: Database Management Systems – Logical Data models – Data Warehouses – Telecommunications and Networks: The

Telecommunication System – Networks – Telecommunications Applications – Internet Evolution of the Internet – Operation of the Internet – WWW- Intranets and Extranets.

Unit:4

Functional, Enterprises, and Inter-organizational Systems: Information System to Support Business Functions – Transaction Processing Information Systems – Accounting and Finance System – Marketing and Sales System – Production and Operations Management System – Integrated Information System and Enterprises Resource Planning – Inter-organizational / Global Information System. - Electronic Commerce.

Unit:5

Information Systems Development: Information System Planning – Traditional Systems Development Life Cycle – Alternative Methods for System Development – System Development Outside the IS Department – Building Internet and Intranet Applications – Implementing: Ethics, Impacts and Security.

Unit:6 Contemporary Issues

Expert lectures, online seminars – webinars

Text Book

1. Turban, Rainer, Potter "Introduction to Information Technology," 2nd edition, Wiley India, 2007

Reference Book

1. V. Rajaraman – Introduction to Information Technology, Prentice Hall of India, 2007.

Expected Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basics of information technology.	K1, K2
CO2	Gain the knowledge of Hardware and Software technologies.	K2
CO3	Learn the method of organizing data.	K3, K4
CO4	Assess the role of Information Science to an organization	K5
CO5	Understanding the role of IT in organizations.	K5, K6

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

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
NME	**Course Code:** 24PCS2N02		**Course Title**: Fundamentals of Computers and Communications	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	4	100

Course Objectives

The main objectives of this course are to:

1. Know the basics of Computers
2. Learn the internal Components of Computers
3. Understand the OS and its types
4. Study the basics of networks and Internet
5. Get a clear idea on DBMS and its concepts

Unit:1

Introduction: What is computer – Components of Computers – Advantages and Disadvantages of using computers – Computer Software – Categories of Computers - Elements of information systems. The Components of the Systems Unit: Processor – Data representation – Memory – Mobile Computers and Devices.

Unit:2

Input and Output Device: What is input – what are input devices – keyboard – pointing device – mouse – other pointing devices – Voice input –Digital Cameras – Video input – Scanners and Reading devices Terminals – Biometric input - Input devices for physically challenged users-Output: What is output – display devices – Monitors – Printers –Speakers, Headphones and Ear phones – output device for physically challenged users – Storage devices.

Unit:3

Operating Systems and Utility Programs: System software – Operating system – Operating system functions – types of operating systems – standalone operating systems–network operating systems – embedded operating system. Application Software: Application software

– Business software – Graphics and Multimedia Software–Application software for Communication.

Unit:4

Internet and World Wide Web: Internet – History of the Internet – How the Internet works – WWW–E-commerce–Communications and Networks: Communications – Uses of Computer Communications – Networks – Communication software – Communication devices – Communications Channel – Physical transmission media and Wireless transmission media.

Unit:5

Database Management: Databases, Data and Information, The Hierarchy of data–Maintaining data – File processing versus databases – database management systems–relational, object oriented and multidimensional databases – web databases – database administration. Computer Security: Computer security risks – Internet and network attacks –Unauthorized access and use.

Unit:6 Contemporary Issues

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Text Book

1. Gary B. Shelly, Thomas j. Cashman, Misty E.Vermaat, "Introduction to Computers," Cengage Learning, 2008

Reference Books

1. Reema Thareja, “Fundamentals of Computers,” Oxford Univ. Press, 2015
2. Deborah Morley, Charles S. Parker, “Understanding C omputers- Today and Tomorrow”, 14th Edition, Thomson Course Technology, 2012
3. Alexis Leon, Mathew‟s Leon, “Fundamentals of Comput er Science and Communication Engineering”, Vikas Publishing House, New Delhi, 1998.

Expected Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Know the basics and internal parts of Computers.	K1, K2
CO2	Gain the knowledge on OS and its types.	K2
CO3	Understand the basics of networks and Internet.	K3, K4
CO4	Learn the databases and DBMS concepts.	K5
CO5	Understand the role of RDBMS in IT.	K5, K6

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

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong,** **M – Medium,** **L – Low**

Program: M.Sc Computer Science				
NME	**Course Code:** 24PCS2N03		**Course Title**: E - Commerce	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	4	100

Course Objectives

The main objectives of this course are to:

1. Know the mercantile and consumer process model
2. Understand the Consumer's and Merchant's perspective
3. Understand the Electronic payment system
4. Earn an in depth idea on electronic data interchange
5. Gain the knowledge on Internet, growth of internet and its commercial uses

Unit:1

Electronic Commerce – Electronic Commerce Frame work – The Anatomy of Electronic Commerce Applications - Electronic Equipment Consumer Applications - Electronic Commerce Organization Applications - Components of I-Way – Network Access Equipment.

Unit:2

Architecture Framework for Electronic Commerce - World Wide Web as the Architecture – Consumer Oriented Applications – Mercantile Process Models – Mercantile Models from the Consumer”s Perspective and Merchant”s Perspective.

Unit:3

Electronic Payment Systems: Types of Electronic Payment Systems – Digital Token based Electronic Payment Systems–Smart Card and Credit Card Based Electronic Payment Systems – Risk and Electronic Payment Systems – Designing Electronic Payment Systems.

Unit:4

Electronic Data Interchange – EDI Applications in Business – EDI: Legal, Security and Privacy issues EDI and Electronic Commerce – Standardization and EDI – EDI Software Implementation.

Unit:5

Internet and World Wide Web: origin of the Internet – New uses for the Internet – Commercial use of the Internet–Growth of the Internet – Advertising on the Internet.

Unit:6 Contemporary Issues

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Text Book

1. Kalakota and Whinston, "Frontiers of Electronic Commerce", Pearson Education, 2004.

2. Gray P.Scheider, "Fourth Annual Edition Electronic Commerce", Thomson Course Technology, 2003.

Reference Books

1. Kamalesh K. Baja, Debjani Nag, “E-Commerce–The Cutting Edge of Business”, TMH Publications, 2005.

2. Agarwala, K.N, Deeksha Agarwala, "Business on the Net: What‟s and How‟s of E-Commerce;" Macmillan, New Delhi, 2000.

3. Parag Diwan, Sunil Sharma, "Electronic Commerce: A Manager's Guide to E-Business", Excel books, 2005.

Expected Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Learn the introduction on e-commerce.	K1, K2
CO2	Understand the mercantile and consumer process models.	K2
CO3	Analyse the consumers and merchant's perspective on e-commerce.	K3, K4
CO4	Getting an idea on Electronic Data Interchange.	K5
CO5	Gaining the knowledge on Internet.	K5, K6

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

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

***S – Strong, M – Medium, L – Low**

Program: M.Sc Computer Science				
SEC - I	**Course Code:** 24PCS4S01		**Course Title:** Data Visualizations Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	4	60	2	100

Course Objectives

The main objectives of this course are to:

1. To learn the basic functions and operations of Excel and tableau
2. To explore to design, build, and deploy various charts for applications,
3. To comprehend, design and deploy the label and heat map
4. To understand and deploy dashboard
5. To understand the functions of tableau for data process.

LIST OF PROGRAMS

Use the following Dataset

http://www.tableau.com/sites/default/files/training/global_superstore.zip

Implement the following using Excel

1. Create Pie chart for Sales and Sales % by Country (sorted in descending order)
2. Create Bar chart for Sales by Country by Year (rounded to nearest thousand and sorted by Grand Total)
3. Create Line char for Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class)
4. Create Scatter chart for Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class)
5. Create heat map for Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order)
6. Design and create the label for vendor list
7. Design and create the dash board

Implement the following using Tableau

8. Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class)
9. Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class)
10. Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order)

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Expected Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Enable to create and apply Spread sheet and Tableau for various data processing.	K1- K6
CO2	Gains knowledge to create and design various visualization tools in Excel and Tableau.	K1- K6
CO3	Comprehend, create and deploy labels and heat map.	K1- K6
CO4	Enable to create and apply dashboard for various data processing.	K1- K6
CO5	Illustrate and apply data visualization tool for any data set.	K1- K6

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

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	M	S	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-
CO3	S	S	S	S	S	S	-	-	-	-
CO4	S	M	M	S	M	L	-	-	-	-
CO5	M	S	M	L	S	M	-	-	-	-

***S – Strong,** **M – Medium,** **L – Low**

Program: M.Sc Computer Science				
SEC - II	**Course Code:** 24PCS4S02		**Course Title** : Soft Skill Development Lab	
Semester IV	**Hours/Week** 4	**Total Hours** 60	**Credits** 2	**Total Marks** 100

Course Objectives

The main objectives of this course are to:

1. To enable students to gain basic communication skills in professional and social contexts effectively.
2. To acquire useful words and apply them in situational context.
3. To develop listening and reading skills through comprehension passages
4. To enrich the leadership qualities and interpersonal communication
5. To enhance essential characteristics in writing.

EXERCISES

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
16. English through Mass Media

17. Essential Grammar
18. Communicating and collaborating with peer members
19. Team Empowerment
20. Persuasive Communication

Expert lectures, online seminars – webinars

Text Books

1. Uma Narula, "Development Communication: Theory and Practice", Revised Edition, Har-Aanad Publication, 2019.
2. Annette Capel and Wendy Sharp, "Cambridge English: Objective First", Fourth Edition, Cambridge University Press, 2013.
3. Emma Sue-Prince, "The Advantage: The 7 Soft Skills You Need to Stay One Step Ahead", First Edition, FT Press, 2013.
4. Guy Brook-Hart, "Cambridge English: Business Benchmark",Second Edition, Cambridge University Press, 2014.
5. Norman Lewis, "How to Read Better & Faster", Binny Publishing House, NewDelhi, 1978.

Reference Books

1. Michael McCarthy and Felicity O,,Dell, "English Vocabulary in Use:100 Units of Vocabulary Reference and Practice", Cambridge UniversityPress,1996.
2. Murphy, Raymond, "Intermediate English Grammar", Second Edition, Cambridge University Press, 1999.

Expected Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Improves the professional communication skills.	K1- K6
CO2	Apply useful words in the correct situation.	K1- K6
CO3	Improves the listening and reading skills.	K1- K6
CO4	Acquire the leadership qualities.	K1- K6
CO5	Improves the writing ability.	K1- K6

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

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	M	S	S	S	S	-
CO2	S	M	S	S	S	M	S	S	S	-
CO3	S	S	S	S	S	S	S	S	S	-
CO4	S	M	M	S	M	L	S	S	S	-
CO5	M	S	M	L	S	M	S	S	S	-

***S – Strong,** **M – Medium,** **L – Low**