MAHENDRA ARTS & SCIENCE COLLEGE

(AUTONOMOUS)

Affiliated to Periyar University, Salem

[Accredited by NAAC 'A' Grade & Recognized u/s 2(f) and 12(B) of the UGC act 1956]

KALIPPATTI-637501

MASTER OF SCIENCE

SYLLABUS FOR M.Sc. COMPUTER SCIENCE

OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM

FOR THE STUDENTS ADMITTED FROM

THE ACADEMIC YEAR 2019 – 2020 ONWARDS

MAHENDRA ARTS & SCIENCE COLLEGE
(Autonomous)
(Affiliated to Periyar University)
Department of Computer Science and Applications

M.Sc. Computer Science

PREAMBLE

- Bring a new approach to syllabus, not a revision of the existing syllabus.
- Create a unique identity for M.Sc. Computer Science distinct from similar degrees in other related subjects.
- Recommend provision for specialization in M.Sc. Computer Science degree.
- Offers focus on core Computer Science subjects.
- Incorporate advanced and most recent trends.

I - PROGRAMME EDUCATIONAL OBJECTIVES

Upon successful completion of a Major in M.Sc. Computer Science, students will be able to

- Demonstrate expertise through significant technical accomplishments and professional skills in industry.
- Exhibit continuous learning and research for the societal up liftment with human values and ethics.
- Demonstrate a breadth and depth of knowledge in the Discipline of Computer Science

II - PROGRAMME OUTCOMES

- Broad knowledge in core areas of computer science, current and emerging technologies in IT.
- Higher degree of technical skills in problem solving and application development.
- Reasoning skills required to learn advance in computer science and probing attitude and a search for deeper knowledge in science.
- Analytical and managerial skills to enhance employment potential.
- Holistic development with strong emphasis on values and ethics.

III - REGULATIONS

These regulations shall take effect from the academic year 2019-2020, i.e., for students who are to be admitted to the first year of the course during the academic year 2019-20 and thereafter.

1. Objectives of the Course

Computer Science to-day is penetrating all fields of human endeavor and therefore it is necessary to prepare the students to cope with the advanced developments in various fields of Computer Science. The objectives of this course are the following:

(a) To import knowledge in advanced concepts and applications in various fields of Computer Science.

(b) To provide wide choice of elective subjects with updated and new areas in various branches of Computer Science to meet the needs of all students.

2. Eligibility for Admission

A candidate who has passed in B.Sc., Computer Science / BCA / B.Sc. Computer Technology / B.Sc. Information Science / B.Sc. Information Technology degree of this University or any of the Degree of any other university accepted by the syndicate as equivalent thereto.

3. Duration of the Course

The course of study for the M.Sc. Computer Science shall consist of two academic years divided into four semesters with 94 credits. Each Semester consist of 90 working days.

4. Course of Study

The course of study for the M.Sc. Computer Science degree has been divided into the following five categories:

(i) Core Courses
(ii) Elective Courses
(iii) Extra Disciplinary Course
(iv) Project
(v) Enhancement Compulsory Courses

5. Examinations

The course of study shall be based on semester pattern with Internal Assessment under Choice Based Credit System.

The examinations for all the papers consist of both Internal (Continuous Internal Assessment - CIA) and External (End Semester) examinations. The theory/practical examinations shall be conducted for three hours duration at the end of each semester. The candidates failing in any subject(s) will be permitted to appear for the same in the subsequent semester examinations.

6. Structure of the Programme

SEMESTER: I

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE COURSE-I	Design and Analysis of Algorithm	M19PCS01	5	-	4	25	75	100
CORE COURSE-II	Advanced Web Technology	M19PCS02	5	-	4	25	75	100
CORE COURSE-III	Advanced Data Base Management Systems	M19PCS03	4	-	4	25	75	100
CORE COURSE-IV	Compiler Design	M19PCS04	4	-	4	25	75	100
CORE PRACTICAL-I	Practical – I - Algorithm using C++	M19PCSP01	-	4	2	40	60	100
CORE PRACTICAL-II	Practical – II - Advanced Web Technology	M19PCSP02	-	4	2	40	60	100
ELECTIVE COURSE-I	Elective-I		4	-	4	25	75	100
		Total	**22**	**8**	**24**	**205**	**495**	**700**

SEMESTER: II

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE COURSE-V	Distributed Operating System – *	M19PCS05	4	-	4	25	75	100
CORE COURSE-VI	Advanced Java Programming	M19PCS06	4	-	4	25	75	100
CORE COURSE-VII	Cryptography and Network Security	M19PCS07	4	-	4	25	75	100
CORE PRACTICAL-III	Practical - III - Advanced Java	M19PCSP03	-	4	2	40	60	100
ELECTIVE COURSE-II	Elective - II		4	-	4	25	75	100
ELECTIVE COURSE-III	Elective - III		4	-	4	25	75	100
EDC	EDC		4	-	4	25	75	100
ENHANCEMENT COMPULSORY COURSE	Human Rights	M19PHR01	2	-	2	25	75	100
COMPREHENSIVE EXAMINATION – I		M19PCSC01	-	-	1	100	-	100
		Total	**26**	**4**	**29**	**315**	**585**	**900**

Note: * - Open-Book Examination

SEMESTER: III

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE COURSE-VIII	Digital Image Processing	M19PCS08	5	-	4	25	75	100
CORE COURSE-IX	Internet of Things	M19PCS09	4	-	4	25	75	100
CORE COURSE-X	Machine Learning	M19PCS10	5	-	4	25	75	100
CORE PRACTICAL-IV	Practical – IV - Image Processing	M19PCSP04	-	4	2	40	60	100
CORE PRACTICAL-V	Practical – V - Machine Learning / Mini Project	M19PCSP05	-	4	2	40	60	100
ELECTIVE COURSE-IV	Elective - IV		4	-	4	25	75	100
ELECTIVE COURSE-V	Elective - V		4	-	4	25	75	100
Additional credit SWAYAM /MOOC			-	-	1	-	-	-
		Total	**22**	**8**	**25**	**205**	**495**	**700**

SEMESTER: IV

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
ELECTIVE COURSE-VI	Elective – VI		5	-	4	25	75	100
ELECTIVE COURSE-VII	Elective – VII – *		5	-	4	25	75	100
CORE PROJECT	Dissertation and Viva - Voce (Industry/Research	M19PCSPR1	-	5	5	40	60	100
COMPREHENSIVE EXAMINATION – II		M19PCSC02	-	-	1	100	-	100
		Total	**10**	**5**	**14**	**190**	**210**	**400**
		TOTAL	**80**	**25**	**92**	**915**	**1785**	**2700**

Note: * - Open-Book Examination

Summary of Credits, Hours and Mark Distribution

Course Category	Credits				Total Credits	Total Hours	No. of Courses	Max. Marks
	I	II	III	IV				
Major	16	12	12	-	40	44	10	1000
Elective	4	8	8	8	28	30	07	700
Practical	4	2	4	-	10	20	05	500
EDC	-	4	-	-	04	04	01	100
Project	-	-	-	5	05	05	01	100
Enhancement Compulsory Courses	-	2	-	-	02	02	01	100
Comprehensive Exam	-	1	-	1	02	-	02	200
SWAYAM /MOOC	-	-	1	-	01	-	-	-
Cumulative Total	**24**	**29**	**25**	**14**	**92**	**105**	**27**	**2700**

ELECTIVE SUBJECTS

(Students can choose any one course from the given list)

SEMESTER	ELECTIVE – I		
	S.No.	**Course Title**	**Course Code**
I	1.	Mobile Computing	M19PCSE01
	2.	Statistical Computing	M19PCSE02
	3.	Object Oriented System Development	M19PCSE03
	4.	Soft Computing	M19PCSE04
SEMESTER	**ELECTIVE – II**		
	S.No.	**Course Title**	**Course Code**
II	1.	Data Science and Big Data Analytics	M19PCSE05
	2.	Advanced Computer Networks	M19PCSE06
	ELECTIVE – III		
	1.	Data Mining	M19PCSE07
	2.	Web Services	M19PCSE08

SEMESTER	ELECTIVE – IV		
III	S.No.	Course Title	Course Code
	1.	Optimization Techniques	M19PCSE09
	2.	Cloud Computing	M19PCSE10
	ELECTIVE – V		
	1.	WAP and XML	M19PCSE11
	2.	Embedded Systems	M19PCSE12
SEMESTER	ELECTIVE – VI		
IV	S.No.	Course Title	Course Code
	1.	Wireless Networks	M19PCSE13
	2.	Theory of Computation	M19PCSE14
	ELECTIVE – VII		
	1	Artificial Intelligence	M19PCSE15
	2.	Software Project Management	M19PCSE16

EXTRA DISCIPLINARY COURSES OFFERED FOR OTHER DEPARTMENT STUDENTS

Semester	S.No.	Course Title	Course Code
II	1.	Fundamentals of Computers and Communications	M19ECS01
	2.	Principles of Information Technology	M19ECS02

SCHEME OF EXAMINATIONS

1. Question Paper Pattern for Theory Papers

Time: Three Hours Maximum Marks: 75

Part A: (10 x 1 = 10)
Answer ALL Questions
(Objective Type - Two Questions from each unit)

Part B: (5 x 2 = 10)
Answer ALL Questions
(One Question from each unit)

Part C: (5 x 5 = 25)
Answer ALL Questions
(One Question from each unit with internal choice)

Part D: (3 x 10 = 30)
Answer Any Three out of Five Questions
(One Question from each unit)

2. Question Paper Pattern for Practical Papers

QUESTION PATTERN

Time: Three Hours Maximum Marks: 60

Answer ALL Questions

1. One compulsory question from the given list of practical's - 30 Marks
2. One either or type question from the list of practical's – 30 Marks

For each Practical question the marks should be awarded as follows (External)

- Algorithm / Flowchart – 20%
- Writing the program in the main answer book – 30%
- Test and debug the programs – 30%
- Printing the correct output – 20%

(Marks may be proportionately reduced for the error committed in each of the above)

3. Distribution of Marks

The following are the distribution of marks for external and internal for End Semester Examinations and continuous internal assessment and passing minimum marks for Theory / Practical / Project papers of M.Sc. Computer Science programmes.

ESE	EA Total	Passing Minimum for EA	CIA Total	Passing Minimum for CIA	Total Marks Allotted	Passing Minimum (ESE)
Theory	75	38	25	12	100	50
Practical	60	30	40	20	100	50
Project	60	30	40	20	100	50

The following are the distribution of marks for the continuous Internal Assessment in Theory / Practical papers of M.Sc. Computer Science programmes.

THEORY

EVALUATION OF INTERNAL ASSESSMENT

Test	: 10 Marks
Seminar	: 05 Marks
Assignment	: 05 Marks
Attendance	: 05 Marks

Total	: 25 Marks

The passing minimum shall be 50% (12 Marks) out of 25 Marks

PRACTICAL

EVALUATION OF INTERNAL ASSESSMENT

Preparation of Record and submission	: 15 Marks
Internal Practical Examinations	: 25 Marks
Total	: 40 Marks

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

PROJECT

EVALUATION OF INTERNAL ASSESSMENT

Review 1	: 10 Marks
Review 2	: 10 Marks
Review 3	: 10 Marks
Pre-Viva	: 10 Marks
Total	: 40 Marks

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

4. Passing Minimum

The Candidates shall be declared to have passed the examinations if he/she secures not less than 50 Marks in total (CIA mark + Theory Exam mark) with minimum of 12 Marks in the CIA and 38 marks in the End Semester Theory Examinations.

The Candidates shall be declared to have passed the examination if he/she secures not less than 50 Marks in total (CIA mark + Practical Exam mark) with minimum of 20 Marks in the CIA and 30 Marks in the End Semester Practical Examinations.

Failed Candidates in the internal assessment are permitted to improve their internal assessment marks in the subsequent semesters (2 Chances will be given) by written test and by assignment submission.

5. Submission of Record Note Books for Practical Examinations

Candidates appearing for practical examinations should submit a record note books prescribed for practical examinations. The candidates failed to submit the record book shall not be permitted to appear for the practical examinations.

6. Project

The following guidelines to be followed for the project with Viva-voce:

1. The project report should be evaluated for 60 Marks by an external examiner; however the Viva-Voce examination should be conducted by both the external examiner appointed by the college and the internal examiner / guide concerned.
2. The project report may consist of a minimum 75 pages.
3. The candidate has to submit the project report before 20 days of the commencement of IV Semester Examinations.
4. A candidate who fails in the Project or is an absent may resubmit the report, on the same topic, with concern of internal guide with necessary modifications / corrections / improvements in the subsequent Even Semester Examinations for evaluation and shall undergo viva-voce Examinations.

7. Note

a) SWAYAM / MOOC – Free Online Education

SWAYAM / MOOC are an instrument for self-actualization providing opportunities for a life-long learning. Here the student can choose from hundreds of courses, virtually every course taught at the college level, offered by the best teachers in India and elsewhere.

The students can choose an online SWAYAM / MOOC course during their period of study which will earn an extra credit and it will be transferred to the academic records of the students.

b) Comprehensive Examination

This examination is conducted at the end of every year. Mode of the examination is online. The questions are of objective type and they cover the entire year's syllabus.

c) Open Book Examination

- For Open Book Examination students can bring their own book materials for the exam.
- Electronic gadgets are not allowed.

SEMESTER - I

Core Course - I	M.Sc. Computer Science	2019 - 2020
M19PCS01	DESIGN AND ANALYSIS OF ALGORITHM	
Credit: 4		

Objectives

This course covers the fundamental techniques for designing and analysing algorithms, including, Trees, graphs, divide and conquer algorithms and recurrences. It also presents effective search methods, graph algorithms and randomized algorithms.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the basics and data structures of algorithm	K2
CO2	Understand data structures and the concepts of algorithms for searching, sorting	K2
CO3	Understand the Knapsack problem and greedy method	K1
CO4	Apply appropriate algorithms and data structures for various applications	K3
CO5	Analyze the backtracking method and branch and bound	K4

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Book

S.No.	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Ellis Horowitz, SatrajSahni and Sanguthevar Rajasekaran	Fundamentals of Computer Algorithms	Universities Press Private Limited, India	2th Edition 2009

Reference Books

1.	Langsam, Augenstien, Tenenbaum	Data Structures Using C	Tata McGraw-Hill International Edition	2nd Edition 2008
2.	V.Aho, Hopcropft, Ullman	Data Structures and Algorithms	LPE	1st Edition
3.	S.E. Goodman, ST. Hedetniem	Introduction to design and Analysis of Algorithms	Prentice Hall, New Delhi	1st Edition

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	M
CO2	M	M	S	M	S
CO3	S	S	M	S	S
CO4	M	M	S	M	M
CO5	S	M	S	M	S

S- Strong; M-Medium

SEMESTER - I

Core Course - II	M.Sc. Computer Science	2019 - 2020
M19PCS02	ADVANCED WEB TECHNOLOGY	
Credit: 4		

Objectives

This course explores the backbone of web page creation by developing .NET skill and to enrich knowledge about HTML control and web control classes, to provide depth knowledge about ADO.NET. Also to understand the need of usability, evaluation methods for web services.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the overview of ASP.NET and web control classes	K2
CO2	Understand about developing ASP.NET Applications	K2
CO3	Remember the ADO.NET and SQL basics	K1
CO4	Apply ADO control and creating web services	K3
CO5	Evaluate the data list and data grid control in accessing data.	K5

UNIT I

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

UNIT II

Developing ASP.NET Applications - ASP.NET Applications: ASP.NET applications– Code behind- The Global.asax application file Understanding ASP.NET Classes- ASP.NET Configuration. Web Form fundamentals: A simple page applet- Improving the currency converter- HTML control classes- The page class- Accessing HTML server controls. Web controls: Web Control Classes – Auto PostBack and Web Control events- Accessing web

controls. Using Visual Studio.NET: Starting a Visual Studio.NET Project- Web form DesignerWriting code- Visual studio.NET debugging. Validation and Rich Controls: Validation- A simple Validation example- Understanding regular expressions- A validated customer form. State management - Tracing, Logging, and Error Handling.

UNIT III

Working with Data - Overview of ADO.NET - ADO.NET and data management- Characteristics of ADO.NET-ADO.NET object model. ADO.NET data access : SQL basics– Select , Update, Insert, Delete statements- Accessing data- Creating a connection- Using a command with a DataReader - Accessing Disconnected data - Selecting multiple tables – Updating Disconnected data. Data binding: Single value Data Binding- Repeated value data binding- Data binding with data bases. Data list – Data grid – Repeater – Files, Streams and Email – Using XML

UNIT IV

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

UNIT V

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

Text Book

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Mathew Mac Donald	ASP.NET Complete Reference	Tata McGraw-Hill International Edition	2005

Reference Books

1.	Crouch Matt J	ASP.NET and VB.NET Web Programming	Addison Wesley	2002
2.	Liberty, D.Hurwitz	Programming ASP.NET	O'REILLY	3rd Edition 2006

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	S
CO2	M	M	S	M	M
CO3	S	S	M	S	S
CO4	M	M	S	M	M
CO5	S	M	S	M	S

S- Strong; M-Medium

SEMESTER - I

Core Course - III	M.Sc. Computer Science	2019 - 2020
M19PCS03	ADVANCED DATABASE MANAGEMENT SYSTEMS	
Credit: 4		

Objectives

This course presents the advanced concepts of Database Management Systems and various databases like parallel, distributed and object oriented database management systems.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the concepts of ER model and Normalization	K1
CO2	Understand the Object based databases and data types	K2
CO3	Remember various data's in spatial database	K1
CO4	Apply the XML databases in various process	K3
CO5	Analyze the multimedia databases and broadcast data	K4

UNIT I

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

UNIT II

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

UNIT III

Spatial Database: Spatial Database Characteristics, Spatial Data model, Spatial Database Queries, Techniques of Spatial Database Query. **Logic based Databases:** Introduction, Overview, Propositional Calculus, Predicate calculus, Deductive Database Systems, Recursive Query Processing.

UNIT IV

XML Databases: XML Hierarchical data model, XML Documents, DTD, XML Schema, XML Querying, XHTML, and Illustrative Experiments.

UNIT V

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

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Abraham Silberschatz, Henry F Korth , S Sudarshan	Database System Concepts	McGraw-Hill International Edition	6th edition 2011
2.	C.J.Date, A.Kannan, S.Swamynathan	An Introduction to Database Systems	8th Edition, Pearson Education	Reprint 2016

Reference Books

1.	RamezElmasri, Shamkant B Navathe	Fundamental of Database Systems	Pearson Education	7th Edition 2016
2.	Thomas Connolly, Carolyn Begg.	Database Systems a practical approach to Design implementation and Management	Pearson Education	2014

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	S
CO2	M	S	S	M	M
CO3	S	M	M	S	S
CO4	M	S	S	M	S
CO5	S	S	M	S	M

S- Strong; M-Medium

SEMESTER - I

Core Course - IV	M.Sc. Computer Science	2019 - 2020
M19PCS04	COMPILER DESIGN	
Credit: 4		

Objectives

This course presents the advanced concepts of Compiler Design techniques that can be used to construct various phases of compiler.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember acquire knowledge about finite automata and regular expressions	K1
CO2	Evaluate context free grammars, compiler parsing techniques	K5
CO3	Apply knowledge about syntax directed definitions and translation scheme	K3
CO4	Analyze the Intermediate code generation of compiler	K4
CO5	Understand intermediate machine representations and actual code generation	K2

UNIT I

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

UNIT II

Syntax Analysis: The role of the parser - Context-free grammars - Writing a grammar - Top down Parsing - Bottom-up Parsing - LR parsers-LALR parsers.

UNIT III

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

UNIT IV

Intermediate Code Generation: Variants of Syntax trees – Three Address code – Types and Declarations - Translation of Expressions – Type checking - Control flow - Back patching - Switch Statements - Procedure calls.

UNIT V

Code Generation and Code Optimization: Issues in the design of a code generator - The target language – Address in the Target Code – Basic Block and Flow graphs – Optimization of Basic Blocks - A simple code generator – Peephole Optimization.

Text Book

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Alfred V. Aho, Monica S.Lam, Ravi Sethi and Jeffrey D. Ullman	Compilers Principles and Tools	Pearson Education Asia	2nd edition 2009

Reference Books

1.	A.V. Aho, Ravi Sethi, J.D. Ullman	Compilers - Principles, Techniques and Tools	Addison-Wesley	2003
2.	Fischer, Leblanc	Crafting a Compiler (Benjamin Cummings)	Menlo Park	1988
3.	Kennath C.Louden	Compiler Construction Principles and Practice	Vikas publishing House	2004
4.	Allen I. Holub	Compiler Design in C	Prentice Hall of India	2001
5.	S.Godfrey Winster, S.Aruna Devi, R.Sujatha	Compiler Design	Yesdee Publishers	Third Reprint 2019

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	S
CO2	M	S	S	M	S
CO3	S	M	M	S	M
CO4	M	S	S	M	S
CO5	S	S	M	S	M

S- Strong; M-Medium

SEMESTER - I

Core Practical - I	M.Sc. Computer Science	2019 - 2020
M19PCSP01	PRACTICAL I - ALGORITHM USING C++	
Credit: 2		

Objectives

This course covers the fundamental techniques for designing and analysing algorithms, including performance analysis, stack and queue divide and conquer algorithms and recurrences, dynamic programming, backtracking. It also presents effective search methods, graph algorithms and randomized algorithms

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand data structures and the concepts of Stack and Queue	K2
CO2	Remember the Algorithm for Binary Search and Selection Sort	K1
CO3	Apply the major algorithms for Kruskal algorithm and single source shortest path	K3
CO4	Understand the concept of Knapsack and dynamic programming	K2
CO5	Analyse the backtracking method	K4

List of Practical's

1. Program for stack Implementation
2. Develop a program for priority Queue
3. To implement a program for binary search
4. Write a program for selection sort
5. To find minimum cost spanning tree using Kruskal's algorithm
6. Implement a program for single source shortest path
7. Using dynamic programming develop a knapsack problem
8. Develop a travelling salesman problem using dynamic Programming method
9. To implement 8 queen's problem using backtracking
10. Write a program for graph coloring using backtracking

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	S	M	S
CO3	M	S	M	S	M
CO4	M	S	M	S	M
CO5	S	M	S	M	S

S- Strong; M-Medium

SEMESTER - I

Core Practical II	M.Sc. Computer Science	2019 - 2020
M19PCSP02	PRACTICAL – II ADVANCED WEB TECHNOLOGY	
Credit: 2		

Objectives

This course introduces the concepts of Dot net Programming. It provides technical skill, basic concepts like data items, lists, dictionaries and tuples and develops various applications

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the fundamental concept of Web Programming	K1
CO2	Understand the concepts of Objects and Controls used for web development	K2
CO3	Apply how the Information passing between websites.	K3
CO4	Apply the in-depth knowledge of data process.	K3
CO5	Analyze the data process in various real time applications.	K4

List of Practical's

1. Change the background color of web page using .NET color properties
2. Execute Currency convertor in ASP.NET.
3. Demonstrate Auto Post back Event Tracking in ASP.NET
4. Generate a table dynamically in ASP.NET.
5. Write a program in ASP.NET to demonstrate the use of file uploading control
6. Generate Online greeting card in ASP.NET
7. Write a program in ASP.NET to demonstrate calendar control properties
8. Design a web page in ASP.NET that make use of Ad Rotator control
9. Create a registration form using validation controls in ASP.NET
10. Design a ASP.NET program to demonstrate Session State management.
11. Develop a program in ASP.NET to demonstrate Application State management
12. Design a web form and write a program to get information using Query String from the form.
13. Write a program to demo Cookies in ASP.NET

14. Develop an application in ASP.NET to access data using Data Grid control
15. Write a program in ASP.NET to access data using Data List control
16. Construct a database application to store and retrieve student data using ADO.NET control.
17. Make use of ADO.NET control to generate electricity bill.

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	M	S	M	S	M
CO5	S	M	S	M	S

S- Strong; M-Medium

SEMESTER - II

Core Course – V	M.Sc. Computer Science	2019 - 2020
M19PCS05	DISTRIBUTED OPERATING SYSTEM	
Credit: 4		

Objectives

This course introduces the architecture of distributed operating system concepts. It also includes hardware, software and communication in distributed OS. To learn the distributed resource management components, and program the principles of OS.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the concept of distributed operating system	K1
CO2	Knowledge on mutual exclusion and deadlock detection of distributed operating system	K2
CO3	Apply the concept of design issues, algorithm	K3
CO4	Understand the recovery approaches, to implement fault tolerance issues and commit protocols	K2
CO5	Analyze effective synchronization process and various operating system to run a task in a distributed system.	K4

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Failure Recovery and Fault Tolerance – Concepts – Failure Classifications – Approaches to Recovery – Recovery in Concurrent Systems – Synchronous and Asynchronous Check pointing and Recovery –Check pointing in Distributed Database Systems – Fault Tolerance Issues – Two-Phase and Non-blocking Commit Protocols – Voting Protocols – Dynamic Voting Protocols.

UNIT V

Multiprocessor and Database Operating Systems –Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory management – Reliability/Fault Tolerance – Database Operating Systems – concepts – Features of Android OS, Ubuntu, Google Chrome OS and Linux operating systems.

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	MukeshSinghal N. G.Shivaratri	Advanced Concepts in Operating Systems	McGraw Hill	2000
2.	Andrew S. Tanenbaum	Distributed Operating System	PHI	-

Reference Books

1.	Abraham Silberschatz, Peter B.Galvin, G.Gagne	Operating Concepts	Addison Wesley publications	6th Edition 2003
2.	Andrew S.Tanenbaum	Modern Operating Systems	Addison Wesley	2nd Edition 2001

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	S	M	M	S
CO3	M	M	S	S	M
CO4	M	S	M	M	S
CO5	S	M	S	S	M

S- Strong; M-Medium

SEMESTER - II

Core Course – VI	M.Sc. Computer Science	2019 - 2020
M19PCS06	ADVANCED JAVA PROGRAMMING	
Credit: 4		

Objectives

This course introduces advance concepts such as networking, AWT controls and Java Beans. It covers concepts such as Applet, Swing, Servlet and Event Handling methods. It provides technical skills to design and develop various internet applications.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the basic concepts of Design patterns and collections.	K2
CO2	Remember the basic APPLETT, AWT and SWING concepts.	K1
CO3	Apply the basic operations of JDBC and My SQL server.	K3
CO4	Analyze the techniques of SERVLETS and JSB.	K4
CO5	Understand the concept of Web development using Java script with using query framework.	K2

UNIT I

Design Patterns: Introduction to Design patterns - Catalogue for Design Pattern - Factory Method Pattern, Prototype Pattern, Singleton Pattern - Adapter Pattern- Proxy Pattern-Decorator Pattern Command Pattern - Template Pattern- Mediator Pattern-Collection Framework – Array List class – Linked List class – Array List vs. Linked List - List Iterator interface - Hash Set class - Linked Hash Set class - Tree Set class Priority Queue class - Map interface - Hash Map class - Linked Hash Map class – Tree Map class - Comparable interface -Comparator interface - Comparable vs. Comparator.

UNIT II

Applet Fundamentals : Applet Class - Applet lifecycle - Steps for Developing Applet Programs - Passing Values through Parameters - Graphics in Applets - GUI Application - Dialog Boxes - Creating Windows - Layout Managers – AWT Component classes – Swing component classes - Borders – Event handling with AWT components - AWT Graphics classes - File Choosers - Color Choosers – Tree – Table – Tabbed panels – Progressive bar - Sliders.

UNIT III

JDBC: Introduction - JDBC Architecture - JDBC Classes and Interfaces – Database Access with MySQL - Steps in Developing JDBC application - Creating a New Database and Table with JDBC - Working with Database Metadata; Java Networking Basics of Networking - Networking in Java - Socket Program using TCP/IP - Socket Program using UDP - URL and Inet address classes..

UNIT IV

Servlet : Advantages over Applets - Servlet Alternatives - Servlet Strengths - Servlet Architecture - Servlet Life Cycle – Generic Servlet, Http Servlet - First Servlet - Invoking Servlet - Passing Parameters to Servlets - Retrieving Parameters - Server-Side Include – Cookies- JSP Engines - Working with JSP - JSP and Servlet - Anatomy of a JSP Page – Database connectivity using Servlets and JSP.

UNIT V

Lambda Expressions: Method Reference- Functional Interface- Streams API, Filters- Optional Class- Nashorn- Base 64 Encode Decode- JShell(RPEL)- Collection Factory Methods- Private Interface Methods- Inner Class Diamond Operator- Multi resolution Image API.

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Bert Bates, Karthy Sierra , Eric Freeman, Elisabeth Robson	Head First Design Patterns	O'REILLY Media Publishers	-- 1st-Unit
2.	Herbert Schild	Java: A Beginner Guide	Oracle Pres-Seventh Edition	(2nd and 3rd Unit)
3.	Murach's	Java Servlets and JSP	Mike Murach & Associates Publishers	2nd Edition, 3rd Edition (4th Unit)
4.	Warburton Richard	Java 8 Lambdas	Shroff Publishers & Distributors Pvt. Ltd	-- (5th Unit)

Reference Books

1.	Paul Deitel and Harvey Deitel	Java: How to Program	Prentice Hall Publishers	-- 9th Edition
2.	Jan Graba	An Introduction to Network Programming with Java-Java 7 Compatible	Springer	-- 3rd Edition

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	M	S	M
CO5	M	S	M	M	S

S- Strong; M-Medium

SEMESTER – II

Core Course - VII	M.Sc. Computer Science	2019 - 2020
M19PCS07	CRYPTOGRAPHY AND NETWORK SECURITY	
Credit: 4		

Objectives

This course provides the technology behind the network security, methods of Encryption, web security, IP security. And also learn about intruders, malicious software's and firewalls.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the basic concepts of Information security basics and encryption techniques	K2
CO2	Remember the Concept symmetric encryption and public key cryptography	K1
CO3	Apply to authentication application and E-mail security.	K3
CO4	Apply to IP security, web security and network management security	K3
CO5	Analysis the concept of intruders, malicious software and firewalls	K4

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Behrouz A. Ferouzan	Cryptography & Network Security	Tata McGraw Hill	2007
2.	Stallings William	Cryptography and Network Security - Principles and Practice	--	2017
3.	William Stallings	Network Security Essentials Applications and Standards	Pearson Education	Third Edition 2008

Reference Books

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

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	M	S	M
CO5	M	S	M	M	S

S- Strong; M-Medium

SEMESTER - II

Core Practical - III	M.Sc. Computer Science	2019 - 2020
M19PCSP03	PRACTICAL III - ADVANCED JAVA	
Credit: 2		

Objectives

This course introduces the concepts of Java programming. It provides technical skill, advanced concepts like Java bean, Networking, Servlet, Applet and JDBC connectivity.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the basic java classes and methods	K1
CO2	Understand the fundamental programming concepts	K2
CO3	Apply the programming technique to analyze software problems	K3
CO4	Apply the concepts to develop a simple graphics and records	K3
CO5	Analyze and develop the internet application	K4

List of Programs

1. Collections using Set, List and Map interfaces
2. Applet programs
3. AWT & SWING Controls
4. CRUD operation Using JDBC
5. Displaying Query Results in a Table
6. TCP Socket
7. UDP Socket
8. Web application using Servlet and JDBC
9. Cookies and Session tracking
10. Client-Side and Server-Side programming

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	M	S	S	S	S
CO3	S	M	M	S	M
CO4	M	S	S	M	M
CO5	S	M	M	M	S

S- Strong; M-Medium

SEMESTER - III

Core Course – VIII	M.Sc. Computer Science	2019 - 2020
M19PCS08	DIGITAL IMAGE PROCESSING	
Credit: 4		

Objectives

To provide Complete Knowledge on Digital Image Processing Methods, such as image processing methods in Spatial domain and Frequency domain, Edge detection, Compression, Segmentation and Morphological concepts which enable the students to understand the concepts and implement them empirically.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Review the Fundamental concepts of a digital image processing system	K1
CO2	Analyze images in the Frequency domain using various transforms	K3
CO3	Analyze the various types of Edge detection techniques	K3
CO4	Apply appropriate Image Compression Standards and Interpret image Segmentation and representation techniques	K4
CO5	Evaluate the results Region-based Segmentation	K5

UNIT I

Fundamentals: Image Sensing and Acquisition, Image Sampling and Quantization, relationship between Pixels; Random noise; Gaussian Markov Random Field, σ-field, Linear and Non-linear Operations; Image processing models: Causal, Semi-causal, Non-causal models.

Color Models: Color Fundamentals, Color Models, Pseudo-color Image Processing, Full Color Image Processing, Color Transformation, Noise in Color Images.

UNIT II

Spatial Domain: Enhancement in spatial domain: Point processing; Mask processing; Smoothing Spatial Filters; Sharpening Spatial Filters; Combining Spatial Enhancement Methods.

Frequency Domain: Image transforms: FFT, DCT, Karhunen – Loeve transform, Hotlling's T^2 transform, Wavelet transforms and their properties. Image filtering in frequency domain.

UNIT III

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

UNIT IV

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

UNIT V

Image Segmentation: Detection and Discontinuities: Edge Linking and Boundary Deduction; Threshold; Region-Based Segmentation. Segmentation by Morphological watersheds. The use of motion in segmentation, Image Segmentation based on Color.

Morphological Image Processing: Erosion and Dilation, Opening and Closing, Hit-Or-Miss Transformation, Basic Morphological Algorithms, Gray-Scale Morphology.

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Rafael C.Gonazalez, Richard E. Woods	Digital Image Processing	PHI/Pearson Education .	4th Edition,2013
2.	A. K. Jain	Fundamentals of Image Processing	PHI	2nd Edition 2015

Reference Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	B.Chanda, D.Dutta Majumder	Digital Image Processing and Analysis	PHI	2003
2.	Nick Efford	Digital Image Processing a practical introducing using Java	Pearson Education	2004
3.	Todd R.Reed	Digital Image Sequence Processing Compression, and Analysis	CRC Press	2015
4.	L.Prasad, S.S.Iyengar	Wavelet Analysis with Applications to Image Processing	CRC Press	2015

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S
CO2	M	M	M	S	M
CO3	S	S	M	M	S
CO4	M	M	S	S	M
CO5	S	S	S	M	S

S- Strong; M-Medium

SEMESTER III

Core Course- IX	M.Sc. Computer Science	2019 - 2020
M19PCS09	INTERNET OF THINGS	
Credit: 4		

Objectives

This course gain knowledge on bases of Internet of Things (IoT),IoT Architecture, and the Protocols related to IoT, and understand the concept of the Web of Thing and the relationship between IoT and WoT.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the IoT Enabling Technologies	K2
CO2	Remember the IoT reference model and IoT architecture	K1
CO3	Analyze applications of IoT in real time scenario	K3
CO4	Apply web services to access /control IoT devices	K4
CO5	Analyze IoT application and connect to the cloud	K3

UNIT I

INTRODUCTION TO IoT: Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels and Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

UNIT II

IoT ARCHITECTURE: M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.

UNIT III

IoT PROTOCOLS: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security

UNIT IV

WEB OF THINGS: Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. **Cloud of Things:** Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT V

APPLICATIONS: The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronizations and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging.

Reference Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Arshdeep Bahga, Vijay Madisetti	Internet of Things – A hands-on approach	Universities Press	2015
2.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian	Architecting the Internet of Things	Springer	2011
3.	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle	From Machine-to Machine to the Internet of Things - Introduction to a New Age of Intelligence	Elsevier	2014
4.	David Easley and Jon Kleinberg	Networks, Crowds, and Markets: Reasoning About a Highly Connected World	Cambridge University Press	2010
5.	Olivier Hersent, David Boswarthick, Omar Elloumi	The Internet of Things – Key applications and Protocols	Wiley	2012

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	S	M	S	S	M
CO3	M	S	M	M	M
CO4	S	M	S	S	S
CO5	S	S	M	S	M

S- Strong; M-Medium

SEMESTER - III

Core Course – X	M.Sc. Computer Science	2019 - 2020
M19PCS10	MACHINE LEARNING	
Credit: 4		

Objectives

- To Learn about Machine Intelligence and Machine Learning applications
- To implement and apply machine learning algorithms to real-world applications.
- To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.
- To understand how to perform evaluation of learning algorithms and model selection.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the fundamental issues and challenges of machine learning: data, model selection, model complexity	K1
CO2	Have an understanding of the strengths and weaknesses of many popular machine learning approaches.	K2
CO3	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning	K4
CO4	Design the various machine learning algorithms	K3
CO5	Be able to implement various machine learning algorithms in a range of real-world applications	K3

UNIT I

Introduction: Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II

Neural Networks and Genetic Algorithms : Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III

Bayesian and Computational Learning : Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV

Instant Based Learning : K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT V

Advanced Learning : Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.

Text Book

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS / EDITION	YEAR OF PUBLICATION
1.	Tom M. Mitchell	Machine Learning	McGraw-Hill Education (India) Private Limited	2013

Reference Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS / EDITION	YEAR OF PUBLICATION
1.	EthemAlpaydin	Introduction to Machine Learning (Adaptive Computation and Machine Learning)	The MIT Press	2004
2.	Stephen Marsland	Machine Learning An Algorithmic Perspective	CRC Press	2009
3.	Michael Affenzeller, Stephan Winkler, Stefan Wagner, Andreas Beham	Genetic Algorithms and Genetic Programming	CRC Press Taylor and Francis Group	--

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	M	S	M
CO5	M	S	M	M	S

S- Strong; M-Medium

SEMESTER III

Core Practical - IV	M.Sc. Computer Science	2019 - 2020
M19PCSP04	PRACTICAL IV - IMAGE PROCESSING LAB	
Credit: 2		

Objectives

This course presents the introduction to digital image processing, fundamentals, and image enhancement and image restoration techniques

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the basic Relationship between Pixels	K2
CO2	Remember the fundamental Spatial Enhancement Methods	K1
CO3	Apply appropriate Image Compression Standards	K3
CO4	Analyze the techniques Geometric Transformations.	K4
CO5	Evaluate the results Region-based Segmentation	K5

List of Practical's

1. To create a Program to Display of Grayscale Images Using read and write operation.
2. To create a vision program to find histogram value and display histograph of a Grayscale and color image.
3. To create a vision program for Non- linear Filtering technique using edge detection**.**
4. To create a vision program to determine the edge detection using different operators.
5. To create a Program 2-D DFT and DCT.
6. To create a Program to eliminate the high frequency components of an image.
7. To create a Program to Display of color images and perform read and write operations.
8. To create a Program to obtain the RGB color values from Conversion between color spaces.
9. To create a Program performs discrete DWT of Images.
10. To create a Program for Segmentation of an image using watershed transforms

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S
CO2	S	M	M	S	M
CO3	S	S	M	M	S
CO4	S	M	S	S	M
CO5	S	S	S	M	S

S- Strong; M-Medium

SEMESTER III

Core Practical - V	M.Sc. Computer Science	2019 - 2020
M19PCSP05	PRACTICAL V - MACHINE LEARNING	
Credit: 2		

Objectives

This course provides the technology to learn about the machine and to develop the application by using PYTHON language to command over the machine by using various algorithms.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the concepts of linear regression and logistic regression.	K1
CO2	Apply the basic operations of decision tree and SVM.	K3
CO3	Apply the concept of Naïve Bayes and KNN.	K3
CO4	Apply the operations of K- means.	K3
CO5	Understand the concept of random forest and dimensionality reduction algorithm.	K2

List of Programs

The following algorithms can be implemented using PYTHON/ R

1. Linear Regression
2. Logistic Regression
3. Decision Tree
4. SVM
5. Naive Bayes
6. KNN (K- Nearest Neighbors)
7. K-Means
8. Random Forest
9. Dimensionality Reduction Algorithms

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	M	S	M
CO5	M	S	M	M	S

S- Strong; M-Medium

ELECTIVE SUBJECTS

ELECTIVE I

Elective - 01	M.Sc. Computer Science	2019 - 2020
M19PCSE01	MOBILE COMPUTING	
Credit: 4		

Objectives

This course introduces basics of mobile telecommunication system. It covers concepts such as wireless networks, mobile internet protocol, wireless protocol and security. It provides technical skills to design and develop mobile platforms and applications.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the basic concepts of Mobile Computing	K2
CO2	Remember the Mobile GUIs	K1
CO3	Analyze the basics of mobile Payment System	K4
CO4	Understand the Mobile Ad hoc networks and its routing	K2
CO5	Apply the different types of security features	K3

UNIT I

Basics of Mobile: Mobile device profiles - Middleware and gateways - Wireless Internet - Smart clients - Three-tier Architecture- Design considerations for mobile computing- Mobility and Location based services.

UNIT II

Mobile computing through Internet - Mobile-enabled Applications - Developing Mobile GUIs – VUIs and Mobile Applications – Characteristics and benefits -Multichannel and Multi modal user interfaces – Synchronization and replication of Mobile Data - SMS architecture – GPRS – Mobile Computing through Telephony.

UNIT III

Mobile Application Development - Android- Wi-Fi –GPS – Camera – Movement – orientation - event based programming – iOS/ windows CE - Blackberry – windows phone – M-Commerce- structure – pros & cons – Mobile payment system - J2ME.

UNIT IV

ADHOC Wireless Network - Ad Hoc Wireless Network –MAC protocol – Routing protocols - Transport Layer Protocol - QoS – Energy Management – application design – work flow – composing applications – Dynamic linking – Intents and Services – Communication via the web.

UNIT V

Security and Hacking - Password security – Network security – web security – Database security **-** Wireless Sensor Network - Architecture and Design – Medium Access Control – Routing – Transport Layer – Energy model.

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Jochen Schiller	Mobile Communications	Pearson Education	Second Edition, 2012
2.	William Stallings	Wireless Communication and Networks	Pearson Education	2009

Reference Books

1.	C.Siva Ram Murthy, B.S. Manoj	Ad Hoc Wireless Networks – Architectures and Protocols	Pearson Education	2nd Edition 2004
2.	Ashok K Talukder, Roopa R Yavagal	Mobile Computing	Tata McGraw Hill	2005
3.	Jochen Burkhardt Dr.Horst Henn, Klaus Rintdoff, Thomas Schack	Pervasive Computing	Pearson	2009
4.	Fei Hu Xiaojun Cao	Wireless Sensor Networks Principles and Practice	CRC Press	2010

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	M	S	S
CO5	M	S	M	S	M

S- Strong; M-Medium

ELECTIVE I

Elective -01	M.Sc. Computer Science	2019 – 2020
M19PCSE02	STATISTICAL COMPUTING	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	understand the applications of various correlation methods	K2
CO2	Remember the Regression analysis with equations	K1
CO3	Apply the study and model the sampling concepts	K3
CO4	Analyze the distribution samplings	K4
CO5	Analyze acquire knowledge on Hypotheses test	K4

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Sampling and Sampling Distributions: Data Collection- Sampling and Non-Sampling Errors – Principles of Sampling- Merits and Limitations of Sampling- Methods of Sampling- Parameter and Statistic- Sampling Distribution of a Statistic- Examples of Sampling Distributions- Standard Normal, Student's *t*, Chi-Square (x^2) and Snedecor's F- Distributions(14.1-14.16).

UNIT V

Statistical Inference- Estimation and Testing of Hypothesis: Statistical Inference- Estimation- Point and interval- Confidence interval using normal, *t* and x^2 Distributions- Testing of Hypothesis- Significance of a mean - Using *t* Distribution(15.1-15.10.2).

Text Book

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	K.L. Sehgal	Quantitative Techniques and Statistics	Himalaya Publishing House	First Edition 2011

Reference Books

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

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	S
CO2	S	S	S	M	S
CO3	M	M	M	S	M
CO4	S	S	M	S	S
CO5	S	S	S	M	S

S- Strong; M-Medium

ELECTIVE I

Elective - 01	M.Sc. Computer Science	2019 - 2020
M19PCSE03	OBJECT ORIENTED SYSTEM DEVELOPEMENT	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the object-oriented approach differs from the traditional approach to systems analysis and design	K2
CO2	Analyze, design, document the requirements through use case driven approach	K4
CO3	Learn the importance of modeling and how the Unified Modeling Language represents an object-oriented system using a number of modeling views	K1
CO4	Analyze the difference between various object relationships: inheritance, association and aggregation	K4
CO5	Design the role and function of test cases, testing strategies and test plans in developing object-oriented software	K3

UNIT – I

Fundamentals of OOSD - Overview of Object Oriented Systems Development: Two orthogonal view of the software - OOSD methodology - Why an object orientation. Object basics: Object Oriented Philosophy- Objects – Attributes – Object respond to messages – Encapsulation and information hiding – class hierarchy – Polymorphism – Object relationship

and associations. OOSD life cycle: Software development process – OOSD Use case Driven Approach – Reusability.

UNIT – II

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

UNIT – III

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

UNIT – IV

Object Oriented Design - Object Oriented Design Process and Design Axioms - OOD process- OOD axioms – Corollaries – Design patterns. Designing classes: Designing classes – Class visibility – Refining attributes – Designing methods and protocols – Packages and managing classes. Access layer: Object Store and persistence – DBMS – Logical and physical Database Organization and access control – Distributed Databases and Client Server Computing — Multi database Systems – Designing Access layer classes. View Layer: Designing view layer classes – Macro level process – Micro level process – The purpose of view layer interface – Prototyping the user interface.

UNIT – V

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

Text Book

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Ali Bahrami McGraw-Hill,	Object Oriented Systems Development using UML	Mc Graw Hill	2008

Reference Books

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

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	S	S	M	M	S
CO3	M	S	M	S	M
CO4	M	S	M	S	S
CO5	S	M	S	M	S

S- Strong; M-Medium

ELECTIVE I

Elective - 01	M.Sc. Computer Science	2019 - 2020
M19PCSE04	SOFT COMPUTING	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Learn the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory	K1
CO2	Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic	K2
CO3	Understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations	K2
CO4	Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications	K2
CO5	Apply the different applications of these models to solve engineering and other problems	K3

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Book

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	S.N.Sivanandam, S.N. Deepa	Principles of Soft Computing	Wiley India	2007

Reference Book

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

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	M	S	M
CO3	S	M	M	S	S
CO4	S	S	M	S	M
CO5	M	S	M	M	S

S- Strong; M-Medium

ELECTIVE II

Elective – 02	M.Sc. Computer Science	2019 - 2020
M19PCSE05	DATA SCIENCE AND BIG DATA ANALYTICS	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the concepts of Big Data Analytics	K1
CO2	Understand the Data Analytics methods using R	K2
CO3	Analyze the various Algorithms, validate and testing methods	K4
CO4	Apply the various classification techniques	K3
CO5	Able to apply Hadoop ecosystem components	K3

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Advanced Analytics-Technology and Tools: MapReduce and Hadoop : Analytics for Unstructured Data .- *UseCases* - *MapReduce* - Apache Hadoop – The Hadoop Ecosystem – pig – Hive – Hbase – Manout – NoSQL - Tools in Database Analytics : SQL Essentials – Joins – Set operations – Grouping Extensions – In Database Text Analysis - Advanced SQL – Windows Functions – User Defined Functions and Aggregates – ordered aggregates-MADiib - Analytics

Reports Consolidation – Communicating and operationalizing and Analytics Project – Creating the Final Deliverables : Developing Core Material for Multiple Audiences – Project Goals – Main Findings – Approach Model Description – Key points support with Data - Model details – Recommendations – Data Visualization

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	EMC Education Services	Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data	John Wiley & Sons, Inc	2015

Reference Books

1.	Noreen Burlingame	The little book on Big Data	New Street publishers	2012
2.	Anil Maheshwari	Data Analytics	McGraw Hill Education	2017
3.	Norman Matloff	The Art of R Programming: A Tour of Statistical Software Design	Starch Press	1 Edition 2011
4.	Sandip Rakshit	R for Beginners	McGraw Hill Education	2017
5.	http://www.johndcook.com/R_language_for_programmers.html			
6.	http://bigdatauniversity.com/			
7.	http://home.ubalt.edu/ntsbarsh/stat-ata/topics.htm#rintroduction			

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	M	S	M
CO3	M	S	S	M	M
CO4	S	S	M	S	S
CO5	S	M	S	M	M

S- Strong; M-Medium

ELECTIVE II

Elective – 02	M.Sc. Computer Science	2019 - 2020
M19PCSE06	ADVANCED COMPUTER NETWORKS	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the basic concept about the fundamentals of computer networks	K1
CO2	Understand Error detection and correction in Data link layer	K2
CO3	Analyze the ADSL and Medium Access Layer	K4
CO4	Understand about the service provided by the Network layer	K2
CO4	Understand Error control, flow control in Transport Layer	K2

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Book

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Andrew S. Tanenbaum	Computer Networks	Pearson Education,Inc	5th Edition 2011

Reference Books

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

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	S	S	M	M	S
CO3	M	S	M	S	M
CO4	M	S	M	S	S
CO5	S	M	S	M	S

S- Strong; M-Medium

ELECTIVE III

Elective –03	M.Sc. Computer Science	2019 - 2020
M19PCSE07	WEB SERVICES	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the design principles and application of SOAP and REST based web services	K2
CO2	Design collaborating web services according to a specification	K4
CO3	Learn an application that uses multiple web services a realistic business scenario	K1
CO4	Apply the industry standard to open source tools such as Apache Axis2, Tomcat, Derby and Eclipse to build and test	K3
CO5	Design to deploy and execute web services and web applications	K4

UNIT I

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

UNIT II

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

UNIT III

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

UNIT V

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

UNIT - V

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

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Sandeep Chatterjee, James Webber	Developing Enterprise Web Services, An Architects Guide	Prentice Hall	Nov 2003
2.	Heather Williamson	XML: The Complete Reference	Tata McGraw-Hill Education India	--

Reference Book

1.	Martin Kalin	Java Web Services: Up and Running	O'Reilly Publishers	--

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	M
CO2	S	S	S	S	M
CO3	M	M	S	M	M
CO4	M	S	M	S	S
CO5	S	M	M	M	M

S- Strong; M-Medium

ELECTIVE III

Elective – 03	M.Sc. Computer Science	2019 - 2020
M19PCSE08	DATA MINING	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the concepts of Data mining and data preprocessing	K2
CO2	Remember to implement the data warehousing in Multidimensional data model	K1
CO3	Analyze the Apriori algorithm and its classification by Decision Tree Induction	K4
CO4	Understand the Categorization of major Clustering Techniques	K2
CO5	Apply Spatial Data Mining in Web	K3

UNIT I

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

UNIT II

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

UNIT III

Frequent Patterns, Associations And Classification: The Apriori Algorithm – Definition of Classification and Prediction – Classification by Decision Tree Induction - Bayesian Classification – Rule Based Classification

– Classification by Back Propagation – Lazy Learners – K-Nearest Neighbor – Other Classification Methods.

UNIT IV

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

UNIT V

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

Text Books

S.No	AUTHOR	TITLE OF HE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Jiawei Han and Micheline Kamber	Data Mining Concepts and Techniques	Morgan Kaufmann Publishers	3rd Edition 2011
2.	Ian H. Witten, Eibe Frank, Mark A. Hall	Data Mining: Practical Machine Learning Tools and Techniques	Elsevier	3rd Edition 2014

Reference Books

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

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	M
CO2	S	S	M	M	S
CO3	S	M	S	M	M
CO4	M	S	S	M	S
CO5	S	S	M	S	M

S- Strong; M-Medium

ELECTIVE IV

Elective – 04	M.Sc. Computer Science	2019 - 2020
M19PCSE09	OPTIMIZATION TECHNIQUES	
Credit: 4		

Objectives

- To understand the concepts of optimization.
- To develop mathematical Model of real time cases.
- To study optimization algorithms.

Course Outcomes

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

CO	CO Statement	Knowledge Level
CO1	Remember the Linear Programming	K1
CO2	Understand the Algorithms	K2
CO3	Apply the Transportation all methods	K3
CO4	Analyze the Project scheduling	K4
CO5	Analyze the measurement activities	K5

UNIT I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	KantiSwarup, P.K. Gupta & Manmohan	Operation Research	--	1996
2.	S.Kalavathy	Operations Research	Vikas Publishing House Pvt.Ltd	Second Edition
3.	S.Godfrey Winster, S. Aruna Devi, R.Sujatha	Compiler Design	Yesdee Publishing	--

Reference Books

1.	D.Shanthi, N.Uma Maheswari, S.Jeyanthi	Theory of Computation	Yesdee Publishing	--
2.	John W.Chinneck	Feasibility and Infeasibility in Optimization-Algorithms and Computatonal Methods	Springer	2015

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	M
CO2	S	S	S	S	S
CO3	M	M	S	M	M
CO4	S	S	M	S	S
CO5	M	S	M	S	M

S- Strong; M-Medium

ELECTIVE IV

Elective – 04	M.Sc. Computer Science	2019 - 2020
M19PCSE10	CLOUD COMPUTING	
Credit: 4		

Objectives

This course introduces basics of Cloud Computing concepts, technologies, architecture and applications by introducing and researching state-of-the-art in Cloud Computing fundamental issues, technologies, applications and implementations.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the Cloud Computing environments & computing platforms	K2
CO2	Remember the Cloud data Services	K1
CO3	Understand Cloud Application Design and Application	K2
CO4	Apply the Python data Types and Structures	K3
CO5	Remember the Big Data Analytics and key Management	K1

UNIT I

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

UNIT II

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

UNIT III

Cloud Application Design And Development: Design consideration - Reference Architecture for Cloud Application - Cloud Application Design Methodologies - Data Storage Approaches- Development in Python: Design Approaches – Application: Image Processing - Document Storage - Map Reduce - Social Media Analytics.

UNIT IV

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

UNIT V

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

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Buyya, Vecciola and Selvi,	Mastering Cloud Computing: Foundations and Applications Programming	Tata McGraw Hill	2013
2.	Arshdeep Bahga, Vijay Madisetti	Cloud Computing A Hands – On Approach	Universities press (India) Pvt. limit.	2016

Reference Books

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

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	M	M
CO2	S	M	M	S	S
CO3	M	M	S	M	S
CO4	S	S	S	M	M
CO5	M	S	M	S	M

S- Strong; M-Medium

ELECTIVE V

Elective – 05	M.Sc. Computer Science	2019 – 2020
M19PCSE11	WAP AND XML	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the WAP application architecture and resources	K2
CO2	Remember the WAP gateway and WML structure	K1
CO3	Analyze the basics of WML script and standard libraries	K4
CO4	Develop SOA application using XML and Web services	K2
CO5	Extract information from the Web sites using XML programming	K5

UNIT I

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

UNIT II

WAP Gateways: Definition – Functionality of a WAP gateway – The Web model versus the WAP model – Positioning of a WAP gateway in the network. **Selecting a WAP gateway Basic WML:** Extensible markup

language – WML structure – A basic WML card – Text formatting – navigation – Advanced display features.

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Charles Arehart and Others	Professional WAP with WML, WML Script, ASP, JSP, XML, XSLT, WTA Push and Voice XML (Unit I,II,III)	Shroff Publishers and Distributers Pvt. Ltd.	2000
2.	Eliotte Rusty Harlod	XML TM Bible (Unit IV,V)	Books India (P) Ltd.	2000

Reference Book

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

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	M	S
CO2	M	M	S	S	M
CO3	S	M	M	S	S
CO4	S	M	S	S	M
CO5	M	S	M	M	S

S- Strong; M-Medium

ELECTIVE V

Elective –05	M.Sc. Computer Science	2019 - 2020
M19PCSE12	EMBEDDED SYSTEMS	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	CO Statement	Knowledge Level
CO1	Remember the Computing Systems	K1
CO2	Understand and recognize the classification of Embedded Systems	K2
CO3	Understand the aware of interrupts , hyper threading and software optimization	K2
CO4	Design real time Embedded Systems using the concepts of RTOS	K4
CO5	Analyze the Emulators and Debugging	K3

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Book

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	K. V. Shibu	Introduction to embedded systems	TMH education Pvt.Ltd	2009

Reference Books

1.	Raj Kamal	Embedded Systems: Architecture, Programming and Design	TMH. Second Edition	2009
2.	Frank Vahid, Tony Givargis	Embedded System Design	John Wiley	Third Edition 2006
3.	Cliff Young, Faraboschi Paolo, and Joseph A. Fisher	Embedded Computing: A VLIW Approach to Architecture, Compilers and Tools	Morgan Kaufmann Publishers	2016
4.	David E. Simon	An Embedded Software Primer	Pearson Education	2015

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	M
CO2	S	M	S	S	S
CO3	M	M	M	S	M
CO4	S	S	S	S	M
CO5	S	M	M	M	S

S- Strong; M-Medium

ELECTIVE VI

Elective – 06	M.Sc. Computer Science	2019 - 2020
M19PCSE13	WIRELESS NETWORKS	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand about Wireless Networks, Protocol Stack And Standards	K2
CO2	Learn the latest 3G/4G and Wi-MAX Networks and Architecture	K1
CO3	Apply the concepts of protocols and TCP enhancement	K3
CO4	Design and implement Wireless Network Environment for any application using latest Wireless Protocols And Standards	K3
CO5	Implement different type of applications for Smart phones and Mobile devices with latest Network standards	K4

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

4G Networks: Introduction – 4G Vision – 4G Features And Challenges – Applications Of 4G – 4G Technologies: Multicarrier Modulation, Smart Antenna Techniques, OFDM-MIMO Systems, Adaptive Modulation And Coding With Time Slot Scheduler, Cognitive Radio.

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Jochen Schiller	Mobile communications (UNIT I,II,III)	Pearson Education	Second edition 2012
2.	Vijay Garg	Wireless Communications and Networking (UNIT IV,V)	Elsevier	First edition, 2007

Reference Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Erik Dahlman, Stefan Parkvall, Johanskold and Per Beming	3G Evolution HSPA And LTE For Mobile Broadband	Academic Press	Second Edition, 2008
2.	Anurag Kumar, D.Manjunath, Joy Kuri	Wireless Networking	Elsevier	First Edition 2011
3.	Simon Haykin, Michael Moher, David Koilpillai	Modern Wireless Communications	Pearson Education	First Edition 2013
4.	David G. Messerschmitt	Understanding Networked Applications	Elsevier	2010

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	S
CO2	S	M	S	M	S
CO3	M	S	M	S	M
CO4	S	M	M	S	S
CO5	S	M	S	M	S

S- Strong; M-Medium

ELECTIVE VI

Elective -06	M.Sc. Computer Science	2019 - 2020
M19PCSE14	THEORY OF COMPUTATION	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars	K3
CO2	Remember the concepts of regular expression and automata	K1
CO3	Analyze the CFG grammars and Pushdown automata	K3
CO4	Demonstrate their the understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving	K2
CO5	Evaluate the basic results of the Theory of Computation, state and explain the relevance of the Church-Turing thesis	K5

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Peter Linz	An Introduction to Formal Languages and Automata	Narosa	2005 Third Edition
2.	J.E. Hopcroft, R. Motwani J.D. Ullman	Introduction to Automata Theory, Languages and Computations	Pearson Education	2007 second Edition

Reference Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	H.R. Lewis and C.H. Papadimitriou	Elements of the theory of Computation	Second Edition, Pearson Education	2003
2.	Thomas A. Sudkamp	An Introduction to the Theory of Computer Science,Languages and Machines	Third Edition, Pearson Education	2007
3.	Raymond Greenlaw an H.James Hoover	Fundamentals of Theory of Computation, Principles and Practice	Morgan Kaufmann Publishers	1998
4.	Micheal Sipser	Introduction of the Theory and Computation	Thomson Brokecole	1997
5.	J. Martin	Introduction to Languages and the Theory of computation	Third Edition, Tata Mc Graw Hill	2007

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	S
CO2	S	S	M	M	S
CO3	S	M	S	M	M
CO4	M	S	S	M	S
CO5	S	M	S	M	S

S- Strong; M-Medium

ELECTIVE VII

Elective – 07	M.Sc. Computer Science	2019 - 2020
M19PCSE15	ARTIFICIAL INTELLIGENCE	
Credit: 4		

Objectives

This course introduces advanced concepts about artificial intelligence. It offers a detailed knowledge about the problem solving techniques.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the basic concept about the artificial intelligence	K1
CO2	Understand, generate and test means-end analysis and problem reduction	K2
CO3	Analyze the Blind method	K4
CO4	Understand about trees and adversarial search its algorithm methods	K2
CO5	Apply Fuzziness as multivalence and signal monotonicity	K3

UNIT I

Introduction to Artificial Intelligences - Semantic Nets and Description Matching - Semantic Nets - Good Representation Support Explicit - Exposing Description - Representation has Four Fundamental Parts - Describe and Match Methods and Analogy Problem - Describe and Match Method and Recognition of Abstractions.

UNIT II

Generate and Test - Means - Ends Analysis - and Problem Reduction - Generate – and Test Method - Means - Ends Analysis Method – Problem - Reduction method. Blind Methods: Net search is Really Tree Search - Search Tress Explode Exponentially – Depth - First Search Dives into the Search Tree – Breadth - First Search Pushes Uniformly into the Search Tree - the Right Search Depends on the Tree.

UNIT III

Nondeterministic Search Moves Randomly into the Search Tree - Heuristically Informed Methods - Quality Measurements Turn Depth - First Search into Hill Climbing - Foothills, Plateaus, and Ridges Make Hill Hard to Climb - Beam Search Expands Several Partial Paths and Purges the Rest – Best - First Search Expands the Best Partial Path - Search may Lead to Discovery – Search Alternatives form a Procedure Family - Nets and Optimal Search: the Best Path - Redundant Paths.

UNIT IV

Trees and Adversarial Search: Algorithmic Methods - Heuristic Method - Rules and Rule Chaining - Rule-Based Deducting System - Procedures for Forward and Backward Chaining - Rules, Substrates, and Cognitive Modeling - Rule - Based System Viewed as Substrate - Rule-Based system Viewed as Models for Human Problem Solving.

UNIT V

Fuzziness as Multivalence - Neurons as Functions - Signal Monotonicity - Biological Actions and Signals – Common Signal Functions – Additive Neuronal Dynamics Learning as Encoding Change and Quantization.

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Patrick Henry Winston	Artificial Intelligence	Addison Wesley Publication	3rd Edition 2009
2.	Bart Kosko	Neural Networks and Fuzzy Systems	Addison Wesley Publication	2nd Edition 2004

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	S
CO2	S	S	M	M	S
CO3	S	M	S	M	M
CO4	M	S	S	M	S
CO5	S	M	S	M	S

S- Strong; M-Medium

ELECTIVE VII

Elective – 07	M.Sc. Computer Science	2019 - 2020
M19PCSE16	SOFTWARE PROJECT MANAGEMENT	
Credit: 4		

Objectives

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

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Analyze the scope, cost, timing, and quality of the project, at all times focused on project success as defined by project stakeholders	K1
CO2	Design the project to the organization's strategic plans and business justification throughout its lifecycle	K3
CO3	Identify project goals, constraints, deliverables, performance criteria, control needs, and resource requirements in consultation with stakeholders	K3
CO4	Implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.	K4
CO5	Adapt projects in response to issues that arise internally and externally	K5

UNIT I

Project Management Framework: Introduction: Project - Project management - Relationship among Project, Program and Portfolio management - Project and operations management- Role of project manager - Project management body of knowledge - Enterprise Environmental factors. Project life cycle and Organization: Overview of project life cycle - Projects vs Operational Work - Stakeholders - Organizational influences on

project management. **The Standard for Project Management of a Project**: Project management processes for a project: Common project management process interactions - Projects management process groups - Initiating process group - planning process group - Executing process group - Monitoring and controlling process group - Closing process group.

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books

S.No	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Pennsylvania	A guide to the Project management Body of Knowledge (PMBOK Guide)	Project Management Institute	Fourth Edition,2008
2.	Bob huges, mike cotterell, rajib mall	Software project management	McGraw hill	Fifth Edition,2011
3.	Emerson	Agile Handbook	Philosophie	--

Reference Books

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

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	S
CO2	S	M	S	M	S
CO3	M	S	M	S	M
CO4	S	S	M	S	M
CO5	S	M	S	M	S

S- Strong; M-Medium

EXTRA DISCIPLINARY COURSES

EDC - I		2019 - 2020
M19ECS01	EDC: FUNDAMENTALS OF COMPUTERS AND COMMUNICATIONS	
Credit: 4		

Objectives

To provide the Basic Concepts in Computers and Networking concepts

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the Components of Computers	K1
CO2	Understand the I/O Devices, CPU and Memory	K2
CO3	Analyze Operating system	K3
CO4	Analyze Internet and data communications	K3
CO5	Apply the Database concepts and Computer security	K4

UNIT I

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 – Expansion Slot and Adapter Cards – Ports and Connectors - Buses – Bays – Power Supply – Mobile Computers and Devices.

UNIT II

Input and Output Device: What is input - what are input devices – keyboard –pointing device – mouse – other pointing devices – controllers for gaming and media players – Voice input – Input for PDAs, Smart phones and Tablet Pcs- Digital Cameras – Video input – Scanners and Reading devices Terminals. **Output:** What is output – display devices – Flat panel displays – CRT monitors – Printers – Speakers, Headphones and Ear phones – Other output devices.

UNIT III

Operating Systems and Utility Programs: System software – Operating system – Operating system functions – operating system utility programs – types of operating systems – stand alone operating systems – network operating systems. **Application Software:** Application software – Business software – Graphics and Multimedia Software – Application software for Communication.

UNIT IV

Internet and World Wide Web: Internet – History of the Internet – How the Internet works – WWW – E-commerce – Other Internet Services – Netiquette. Communications and Networks: Communications – Uses of Computer Communications – Networks – Network communication standards – Communication software.

UNIT V

Database Management: Databases, Data and Information, The Hierarchy of data – Maintaining data – 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.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Gary B. Shelly, Thomas j. Cashman, Misty E.Vermaat	Introduction to Computers	Cengage Learning	2008

Reference Books

1.	Deborah Morley, Charles S. Parker,	Understanding Computers-Today and Tomorrow	Thomson Course Technology	11th Edition 2007
2.	Alexis Leon, Mathew's Leon	Fundamentals of Computer Science and Communication Engineering	Vikas Publishing House, New Delhi	1998.

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	M	M
CO2	S	M	S	S	S
CO3	M	S	M	S	M
CO4	M	S	M	M	S
CO5	S	M	S	S	M

S- Strong; M-Medium

EDC - II		2019 - 2020
M19ECS02	EDC: PRINCIPLES OF INFORMATION TECHNOLOGY	
Credit: 4		

Objectives

To Provide the Basic Concepts in Information Technology

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the Generation of Computers	K1
CO2	Understand the CPU and Memory	K2
CO3	Analyze the Programming Language	K3
CO4	Analyze WWW & Internet	K3
CO5	Apply the Computer Security	K4

UNIT I

Introduction to Computers - Generation of Computers - Classification of Digital Computer - Anatomy of Digital Computer.

UNIT II

Computer Architecture – Number System - CPU and Memory - Secondary Story Devices - Input Devices - Output Devices.

UNIT III

Introduction to Computer Software – Programming Language - Operating Systems - Introduction to Database Management System.

UNIT IV

Computer Networks – Communication Systems – Distributed data processing - WWW and Internet - Email – Introduction to intranets – Introduction to E-Commerce and E-Business - Web Design

UNIT V

Computers at Home, Education, Entertainment, Science, Medicine and Engineering - Introduction to Computer Security - Computer Viruses, Bombs, Worms.

Text Book

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION
1.	Alexis Leon and Mathews Leon	Fundamentals of Information Technology	Vikas Publishing House	2009

Reference Book

1.	M.N Doja	Fundamentals of Computers and Information Technlogy	--	2005

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	M	M
CO2	S	M	S	S	S
CO3	M	S	M	M	M
CO4	M	S	M	M	S
CO5	S	M	S	M	M

S- Strong; M-Medium.

ENHANCEMENT COMPULSORY COURSES

SEMESTER - II

ECC	M.Sc. Computer Science	2019 - 2020
M19PHR01	HUMAN RIGHTS	
Credit: 2		

Objectives

This course presents the different aspects of human rights which includes children and women. Students can learn not only basic rights but also can understand the duties to be carried out in the days to come.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Remember the need and types of Human rights	K1
CO2	Understand the Classification of Human Rights	K2
CO3	Apply the Rights of Women and Children	K4
CO4	Learn the Labour Rights	K2
CO5	Analyze the National and State level human Rights Commission	K3

UNIT I

Introduction to Human Rights: Human Rights : Meaning – Definitions – Origin and Growth of Human Rights in the World – Need and types of Human Rights – UNHRC(United nations Human Rights) – Human Rights in India.

UNIT II

Classification of Human Rights: Right to Liberty – Right to Life – Right to Equality – Right to dignity – Right to against Exploitation – Educational Rights – Cultural Rights – Economic Rights – political Rights – Social Rights.

UNIT III

Rights of Women and Children: Rights of Women – Female feticide and Infanticide and selective abortion – Physical assault and sexual harassment – Domestic Violence – Violence at work place – Remedial Measures. Rights of Children – Protection rights, survival rights – Participation rights – Development rights – Role of UN on convention on rights of children.

UNIT IV

Multi-Dimensional aspects of Human Rights: Labour rights – Bodend Labour – Child Labour – Contract Labour – Migrant Labour – Domestic Women Labour – Gender Equity – Rights of Ethnic refugees – Problems and remedies – Role of trade union in protecting the unorganized labourers.

UNIT V

Grievance and Redressal Mechanism: Redressal Mechanism at national level – Structure and functions of National and State level human Rights Commission – constitutional remedies and directive principles of state policy.

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS / EDITION	YEAR OF PUBLICATION
1.	Barat Sergio and Swaronjali Ghosh	Teaching of Human Rights	Dominant Publishers and distributors, New Delhi	2009
2.	Roy A.N	Human Rights Achievements and Challenges	Vista International Publishing House, Delhi	2005
3.	Asish Kumar das and Prasant KumarMonaty	Human Rights in India	Sarup and Sons, New Delhi	2007
4.	Bani Bargohain	Human Rights Social justice and political change	Kanishka publishers and distributors, New Delhi	2007
5.	Velan G,	Human Rights and Development Issues	Ambala Cantt	2008
6.	Meena P K	Human rights Theory and Practice	Murali lal and Sons, New Delhi	2008
7.	Bhavani Prasad Panda	Human Rights Development and Environmental Law	Academic Excellence, Delhi.	2007

8.	Vishvanathan V N	Human Rights – Twenty first Century Challenges	Kalpaz Publications, New Delhi.	2008
9.	Ansari M.R	Protecting Human Rights	Max Ford Books, New Delhi.	2006
10.	Rao M.S.A	Social Movements in Indi – Social Movements and Social Transformation in India	Vol 1&2: Manohar Publications, New Delhi.	1978

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	M
CO2	M	M	S	M	M
CO3	S	S	M	S	S
CO4	M	M	S	M	S
CO5	S	M	S	S	M

S- Strong; M-Medium