A K UNIVERSITY

Program Structure and Syllabus of

M.Sc. Course

2025-26

AK UNIVERSITY – M.Sc. Course Structure

M.Sc. I Year – I Semester

S. No.	Course Code	Category	Course	Max Marks		Hours Per Week			Credits
				I	E	L	T	P	
1	MS101	PC	Python Programming	30	70	3	1	0	4
2	MS102	PC	Database Management Systems	30	70	3	1	0	4
3	MS103	PC	Computer Networks	30	70	3	1	0	4
4	MS104	PC	Artificial Intelligence	30	70	3	1	0	4
5	MS105	HS	Communication Skills Lab	100	-	0	0	6	3
6	MS106	PC-Lab	Python Programming Lab	30	70	0	0	6	3
7	MS107	PC-Lab	Database Management Systems Lab	30	70	0	0	6	3
			TOTAL	**280**	**420**	**12**	**4**	**18**	**25**

M.Sc. I Year – II Semester

S. No.	Course Code	Category	Course	Max Marks		Hours Per Week			Credits
				I	E	L	T	P	
1	MS201	PC	Core Java Programming	30	70	3	1	0	4
2	MS202	PC	Data Structures	30	70	3	1	0	4
3	MS203	PC	Big Data Frameworks	30	70	3	1	0	4
4	MS204A	PE-I	1. Cyber Security Fundamentals	30	70	3	1	0	4
	MS204B		2. Software Engineering						
	MS204C		3. Data Science						
5	MS205	HS	Digital Well Being	100	-	2	0	0	2
6	MS206	PC-Lab	Core Java Programming Lab	30	70	0	0	6	3
7	MS207	PC-Lab	Data Structures Lab	30	70	0	0	6	3
8	MS208	MC	Cloud Computing Fundamentals	-	-	-	-	-	-
			TOTAL	**280**	**420**	**18**	**4**	**12**	**24**

M.Sc. II Year – III Semester

S. No.	Course Code	Category	Course	Max Marks		Hours Per Week			Credits
				I	E	L	T	P	
1	MS301	PC	Advance Java Programming	30	70	3	1	0	4
2	MS302	PC	Machine Learning	30	70	3	1	0	4
3	MS303	PC	R Programming	30	70	3	1	0	4
4	MS304A	PE-II	1. Operating System (OS)	30	70	3	1	0	4
	MS304B		2. Cyber Law						
	MS304C		3. Cryptography & Network Security						
5	MS305	PC-Lab	Advance Java Programming Lab	30	70	0	0	6	3
6	MS306	PC-Lab	Machine Learning Lab	30	70	0	0	6	3
7	MS307	PC-Lab	R Programming Lab	100	-	0	0	6	3
8	MS308	MC	Deep Learning	-	-	0	0	0	0
			Total	**280**	**420**	**12**	**4**	**18**	**25**

M.Sc. II Year – IV Semester

S. No.	Course Code	Category	Course	Max Marks		Hours Per Week			Credits
				I	E	L	T	P	
1	MS401	PC	Data Mining	30	70	3	1	0	4
2	MS402A	PE-III	1. Cloud Computing	30	70	3	0	0	3
	MS402B		2. Computer Forensics						
	MS4042C		3. Distributed Computing						
3	MS403A	PE-IV	1. Block Chain Technology	30	70	3	0	0	3
	MS403B		2. Neural Networks & Deep Learning						
	MS403C		3. Internet of Things (IoT)						
	MS403D		4. Research Methodology & Intellectual Property Rights (IPR)						
4	MS404	PROJ	Major Project	100	-	0	0	4	12
			TOTAL	**190**	**210**	**9**	**1**	**4**	**22**

AK UNIVERSITY – M.Sc. Course Structure

M.Sc. I Year – I Semester

S. No.	Course Code	Category	Course	Max Marks		Hours Per Week			Credits
				I	E	L	T	P	
1	MS101	PC	Python Programming	30	70	3	1	0	4
2	MS102	PC	Database Management Systems	30	70	3	1	0	4
3	MS103	PC	Computer Networks	30	70	3	1	0	4
4	MS104	PC	Artificial Intelligence	30	70	3	1	0	4
5	MS105	HS	Communication Skills Lab	100	-	0	0	6	3
6	MS106	PC-Lab	Python Programming Lab	30	70	0	0	6	3
7	MS107	PC-Lab	Database Management Systems Lab	30	70	0	0	6	3
			TOTAL	**280**	**420**	**12**	**4**	**18**	**25**

Students must be completed certification course

PC : Program Course: MC Mandatory Course **HS: Humanities** **: PE : Professional Elective**

Python Programming					M.Sc. 1st year 1st semester			
Code	Category	Hours / Week			Credits	MARKS		
		L	T	P		Internal	End Exam	Total
MS101	PC	3	1	0	4	30	70	100

Course Objectives

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Languages.
3. Understand the modules and packages in Python Programming Language.
4. Understand File operations in Python Programming Language

Course Outcomes

At the end of course , students will be able to:

1. Apply control structures, functions and packages in Problem Solving. (L3)
2. Analyze various String handling functions and data structures(L4)
3. Model the object-oriented problems with classes and objects (L4)
4. Solve the problems by using Inheritance and polymorphism (L3)
5. Illustrate programs on Exception Handling and various packages(L3)

UNIT I

Problem Solving: Definition and Steps, Problem Analysis Chart, Developing an Algorithm, Flowchart and Pseudo-code. Introduction to python - Interactive and Script Mode - Indentation - Comments - Variables - Reserved Words - Data Types - Operators and their precedence - Expressions - Built-in Functions - Importing from Packages.

UNIT II

Control Structures Decision Making and Branching: if, if-else, nested if, multi-way if-elif statements - Looping: while loop, for loop - else clauses in loops, nested loops - break, continue and pass statements.
Functions and Modules: Declaration and Definition Function Calling, More on Defining Functions, Recursive Functions, Modules, Packages in Python, Doc Strings.

UNIT III

Collection Lists: Create, Access, Slicing, Negative indices, List methods, List comprehensions - Tuples: Create, Indexing and slicing, Operations on tuples - Dictionary: Create, add, and replace values, Operations on dictionaries - Sets: Creation and operations.

Strings and Regular Expressions:String Operations, Built-in String Methods and Functions, Comparing Strings, function in Regular Expression.

UNIT IV

Functions and Files

Functions – Parameters and Arguments: Positional arguments, Keyword arguments, Parameters with default values – Localand Global scope of variables – Functions with Arbitrary arguments – Recursive Functions – Lambda Function. Files: Create, Open, Read, Write, Append and Close – tell and seek methods.

UNIT V

Python NumPy: NumPy ND array, Data Types, Functions of NumPy Array, NumPy Array Indexing, Mathematical Functions on Arrays in NumPy

Python Pandas: Pandas Features, Dataset in Pandas, Data Frames, Manipulating the Datasets, Describing a Dataset, group by Function, Filtering, Missing Values in Pandas, Concatenating Data Frames. Import data from csv file.

Introduction to Matplotlib :, Plot, Scatterplot, Introduction to Tkinter ,Date and Time Packages

Text Book

1. Ashok Namdev Kamthane, Amit Ashok Kamthane, programming and problem solving with python, 2nd edition, McGrahill, 2020.
2. ReemaThareja,Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction,2017
3. James Payne, Beginning Python using Python 2.6 and Python 3,1st Edition

Reference Books

1. Charles Dierach, Introduction to Computer Science using Python,2013
2. https://www.programiz.com/python-programming
3. https://www.javatpoint.com/python-tutorial
4. https://www.geeksforgeeks.org/python-programming-language.

Database Management Systems						M.Sc. 1st year 1st semester		
Code	Category	Hours / Week			Credits	Marks		
		L	T	P	C	Internal	End Exam	Total
MS102	PC	3	1	0	4	30	70	100

Course Objectives

Course Objectives of Database Management Systems are to:

1. Discuss Database management systems, databases and its applications.
2. Familiarize the students with a good formal foundation on the relational model.
3. Outline the various systematic database design approaches.
4. Describe the concepts of transactions and transaction processing and the issues, techniques related to concurrency and recovery manager.
5. Explore the File organizations, indexing and hashing mechanisms.

Course Outcomes

At the end of this Database Management Systems course, students will be able to:

1. Model Entity-Relationship diagrams for enterprise level databases.
2. Formulate Queries using SQL and Relational Formal Query Languages.
3. Apply different normal forms to design the Database.
4. Summarize concurrency control protocols and recovery algorithms.
5. Identify suitable Indices and Hashing mechanisms for effective storage and retrieval of Data.

UNIT I

Introduction to Database System Concepts: Database-System Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Architecture, Database Users and Administrators.

Introduction to the Relation Models and Database Design using ER Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations, Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams- Unary, Binary, ternary, Aggregation.

UNIT II

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested Sub queries.

Formal Relational Query Languages: The Relational Algebra, Tuple Relational Calculus.

UNIT III

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Functional Dependencies, Closure set of Functional dependencies, Procedure for Computing F^+, Boyce Codd Normal form, BCNF Decomposition Algorithm, Third Normal Form, Third Normal Form DecompositionAlgorithm.
Transactions: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Serializability.

UNIT IV

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols.
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, ARIES, Remote Backup Systems.

UNIT V

File Organization: Fixed and variable length records, Sequential file organization, Data Dictionary, Buffer manager.
Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key Access, Static Hashing, Extendible Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

Text Book

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill 2006.

Reference Books

1. Raghu Rama Kirshna, Johannes Gehrke, Database Management System, Third Edition, TATA MCGraw Hill, 2003.
2. C J Date, AKannan, S Swamynathan, An Introduction to Database Systems, Eight Edition, Pearson2006
3. P Raja Sekhar Reddy, A Mallikarjuna Reddy, Foundations of Database Management Systems, Lambert Academic Publishing, 2020 (e-Book)
4. https://www.pdfdrive.com/fundamentals-of-database-systems-pdf-e51477130.html

Computer Networks						M.Sc. 1st year 1st semester		
Code	Category	Hours / Week			Credits	Marks		
MS103	PC	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Course Objectives

Course Objectives of Computer Networks are to:

1. Elaborate the fundamental concepts of computer networks and network models
2. Interpret the error and flow control mechanisms in the data link layer
3. Explore the knowledge of various routing algorithms
4. Describe the transport layer functionalities
5. Illustrate different application layer functionalities

Course Outcomes

At the end of this Computer Networks course, students will be able to:

1. Illustrate the functionalities of various network models and Data Link Layer
2. Analyze error and flow control mechanisms in the data link layer
3. Examine various Routing Protocols
4. Compare various congestion control mechanisms to improve the QoS of networking
5. Identify the suitable Application layer protocols for specific applications

UNIT I

Introduction: Physical Structures, Network Models-Layered Tasks, OSI model, TCP/IP protocol Suite,Addressing. Data Link Layer: Introduction, Hamming Distance, Cyclic Redundancy Check, Checksum.

UNIT II

Data Link Control: Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC. Multiple Access: Random Access, Controlled Access, Channelization.

UNIT III

Network Layer: IPV4 and IPV6 address space, Classful and classless Addressing, IPV4 and IPV6 datagram format, Transition from IPv4 to IPv6, Delivery, Forwarding and Routing, Routing protocols: Distance Vector Routing, Link State Routing, Path Vector Routing.

UNIT IV

Transport Layer: Process-to-Process delivery, Transmission control protocol, User datagram protocol, Data traffic, Congestion Control, Quality of Service, Techniques to improve QoS.

UNIT V

Application Layer: Domain Name Space, Distribution of Name Space, DNS in the Internet, Resolution, DNS Messages, Electronic mail, File Transfer Protocol.

Text Book

1. Behrouz A Forouzan," Data Communications and Networking", 4th Edition, McGraw-Hill, 2007.

Reference Books

1. Andrew S. Tanenbaum, Computer Networks, Third Edition, Prentice Hall, 2012.
2. William Stallings, Data and Computer Communications, Eight Editions. Pearson Publishers, 2008. http://highered.mheducation.com/sites/0072967757/student_view0/index.html

Artificial Intelligence						M.Sc. 1st year 1st semester		
Code	Category	Hours / Week			Credits	MARKS		
		L	T	P	C	Internal	End Exam	Total
MS104	PC	3	1	0	4	30	70	100

Course Objectives

Course Objectives of Artificial Intelligence are to:

1. Summarize overview of artificial concepts
2. Discuss uniform search and informed search
3. Demonstrate how to solve the zero sum gain problem
4. Describe the logic in artificial intelligence and knowledge representation
5. Elaborate notion of different production and expert systems in AI

Course Outcomes

At the end of the Artificial Intelligence course, students will be able to:

1. Describe the concepts and applications of artificial intelligence
2. Compare uniform search and informed search algorithms
3. Solve problems using Zero Sum Game algorithms
4. Represent logic for given problems using facts and rules
5. Summarize functionalities of production and expert systems

UNIT I

Overview of Artificial Intelligence: Introduction. The Turing Test, Strong AI Versus Weak AI, Identifying Problems Suitable for AI, Applications and Methods, Early History of AI, Recent History of AI to the Present, AI in the New Millennium

UNIT II

Uninformed Search: Introduction: Search in Intelligent Systems, State-Space Graphs, Generate-and-Test Paradigm, Blind Search Algorithms, Implementing and Comparing Blind Search Algorithms
Informed Search: Introduction, Heuristics, Informed Search Algorithms – Finding Any Solution, The Best- First Search, The Beam Search, Additional Metrics for Search Algorithms, Informed Search – Finding an Optimal Solution.

UNIT III

Search Using Games: Introduction, Game Trees and Minimax Evaluation, Minimax with Alpha-Beta Pruning, Variations and Improvements to Minimax, Games of Chance and the Expect minimax Algorithm

Logic in Artificial Intelligence: Introduction, Logic and Representation, Propositional Logic, Predicate Logic – Introduction, Several Other Logics, Uncertainty and Probability

UNIT IV

Knowledge Representation: Introduction, Graphical Sketches and the Human Window, Graphs and the Bridges of Königsberg Problem, Search Trees, Representational Choices, Production Systems, Object Orientation, Frames, Semantic Networks

UNIT V

Production Systems: Introduction, Background, Production Systems and Inference Methods, Production Systems and Cellular Automata, Stochastic Processes and Markov Chains, Basic Features and Examples of Expert Systems

Text Book

1. Stephen Lucci, Danny Kopec, Artificial Intelligence in the 21st Century-A Living Introduction,Mercury Learning and Information, Second Edition, 2016

Reference Books

1. Russell, Norvig: Artificial Intelligence, A Modern Approach, Pearson Education, Second Edition, 2004
2. Rich, Knight, Nair: Artificial Intelligence, Tata McGraw Hill, Third Edition, 2009
3. Saroj Kaushik. Artificial Intelligence. Cengage Learning, 2011

Communication Skills Lab						M.Sc. 1st year 1st semester		
Code	Category	Hours / Week			Credits	Marks		
		L	T	P	C	Internal	End Exam	Total
MS105	HS-Lab	0	0	6	3	-	-	100

Introduction

The course aims at preparing the students with the tools needed for successful communication at the professional front. It is designed to improve students' academic and professional skills which the employers are currently looking for.

Course Objective

To prepare the students to use the language effectively in all professional pursuits

Course Outcomes

At the end of this Computer Networks course, students will be able to:

1. Analyze the language use in communicative process
2. Describe the process and product
3. Interpret the ideas in group activities
4. Apply different approaches to comprehend the written text
5. Write any technical and official correspondence within the framework

UNIT I

Essentials of Communication:
Essentials of Grammar-Rudiments of Communications Skills (Listening, Speaking, Reading, and Writing)-Applied Grammar and Usage- Non-Verbal Communication.

UNIT II

Listening Skills:
Art of Listening- Developing Effective Listening Skills-Process of Listening, Intensive & Extensive Listening Podcasts, Vodcasts (ICT enabled) - Five steps to Active Listening-Effective and Ineffective Listening Skills- Listening & Note-taking

UNIT III

Speaking Skills:

Dynamics of Effective Speaking -Group Discussion-Simulated Presentations, Process & Product Descriptions-Proxemics, Paralinguistic Features

UNIT IV

Reading Skills:
The Art of Effective Reading- Basic steps to Effective Reading-Extensive and Intensive Reading - Approaches to Efficient Reading-Reading Comprehension

UNIT V

Writing Skills:
Art of Condensation-Descriptive Writing Techniques-Writing & Answering Memos, Circulars -Inter & IntraOfficial Communication -Writing Minutes of Meeting-Netiquette - E-mail & Blog Writing - Note-making

Text Book

1. Kumar, Sanjay and Pushpa Lata, Communication Skills, Second edition, Oxford University Press,2015.

Reference Books

1. Adair, John. The Effective Communicator. Jaico Publishing House.1995.
2. Adler, B. Ronald. Communicating at Work (Seventh edition.) McGraw Hill.2004.
3. Aruna, Koneru. Professional Communication. McGraw Hill.2017.
4. Ibbotson, Mark. Cambridge English for Engineering Professionals. Cambridge University.2008.
5. Oxford English for Careers. Oxford University Press.

Python Programming Lab						M.Sc. 1st year 1st semester		
Code	Category	Hours / Week			Credits	MARKS		
MS106	PC-Lab	L	T	P	C	Internal	End Exam	Total
		0	0	6	3	30	70	100

Course Outcomes

At the end of this Python Programming Lab course, students will be able to:

1. Develop programs on data types, operators and expressions
2. Apply the data structures in real time scenarios
3. Write programs on strings and functions
4. Implement programs on class and related concepts
5. Solve various exception handling programs and implement the packages

Week 1

Installation and Environment set up of Python & Programs on Data types

Week 2

Programs on Standard I/O, Operators and Expressions

Week 3

Programs on Functions

Week 4

Programs on lists and Tuples

Week 5

Programs on Dictionaries

Week 6

Programs on Strings and string operations

Week 7

Programs on Regular Expressions

Week 8

Programs on class & object, static and instance method implementation

Week 9

Programs on Inheritance and Polymorphism

Week 10

Programs on Stacks and Queues

Week 11

Programs on Exception Handling, Database Connectivity, Executing queries

Week 12

Demonstration of Numpy Package

Week 13

Demonstration of Pandas Package

Week 14

Demonstration of Matplotlib Package and Tkinter Package

Week 15

Demonstration of Date and Time Packages

Note: The above experiments are for indicative purposes only. However, the concerned faculty member can adda few more experiments in addition to the existing. In such cases the concerned faculty member should get the syllabus approved by the BoS.

Database Management Systems Lab						M.Sc. 1st year 1st semester		
Code	Category	Hours / Week			Credits	Marks		
MS107	PC-Lab	L	T	P	C	Internal	End Exam	Total
		0	0	6	3	-	-	100

Course Outcomes

At the end of this Lab course, students will be able to:

1. Apply different types of SQL commands to create, manipulate and access data from the database.
2. Construct a database by using various integrity constraints.
3. Develop basic PL/SQL programs.
4. Implement PL/SQL Programs using procedures, functions and cursors.
5. Create a trigger for a given problem.

List of Experiments

Week 1

1. Database user creation, Data definition Language commands, Data Manipulation commands, DataControl Language Commands, Transaction Control Language commands.

Week 2

1. Database Schema for a customer-sale scenarioCustomer (Cust id: integer, cust_name: string) Item (item_id: integer,item_name: string, price: integer)
Sale (bill_no: integer, bill_data: date, cust_id: integer, item_id: integer, qty_sold: integer) For the above schema, perform the following–

a. Create the tables with the appropriate integrity constraints
b. Insert around 10 records in each of the tables
c. List all the bills for the current date with the customer names and item numbers
d. List the total Bill details with the quantity sold, price of the item and the final amount
e. List the details of the customer who have bought a product which has a price>200
f. Give a count of how many products have been bought by each customer
g. Give a list of products bought by a customer having cust_id as 5
h. List the item details which are sold as of today
i. Create a view which lists out the bill_no, bill_date, cust_id, item_id, price, qty_sold, amount
j. Create a view which lists the daily sales date wise for the last one week

Week 3

2. Database Schema for a Student Library scenario Student (Stud_no : integer,Stud_name: string) Membership (Mem_no: integer,Stud_no: integer)

Book (book_no: integer, book_name:string, author: string) Iss_rec(iss_no:integer, iss_date: date, Mem_no: integer, book_no: integer)

For the above schema, perform the following:

a. Create the tables with the appropriate integrity constraints
b. Insert around 10 records in each of the tables
c. List all the student names with their membership numbers
d. List all the issues for the current date with student and Book names
e. List the details of students who borrowed book whose author is CJDATE
f. Give a count of how many books have been bought by each student
g. Give a list of books taken by student with stud_no as 5
h. List the book details which are issued as of today
i. Create a view which lists out the iss_no, iss _date, stud_name, book name
j. Create a view which lists the daily issues-date wise for the last one week

Week 4

3. Database Schema for a Employee-pay scenario employee (emp_id : integer,emp_name: string) Department (dept_id: integer,dept_name:string)
Paydetails (emp_id : integer,dept_id: integer, basic: integer, deductions: integer, additions: integer, DOJ: date)
Payroll (emp_id : integer, pay_date: date)

For the above schema, perform the following:
Create the tables with the appropriate integrity constraints

a. Insert around 10 records in each of the tables
b. List the employee details department wise
c. List all the employee names who joined after particular date
d. List the details of employees whose basic salary is between 10,000 and 20,000
e. Give a count of how many employees are working in each department
f. Give a name of the employees whose netsalary>10,000
g. List the details for an employee_id=5
h. Create a view which lists out the emp_name, department, basic, deductions, netsalary
i. Create a view which lists the emp_name and his netsalary

Week 5

4. Database Schema for a Video Library scenarioCustomer (cust_no: integer,cust_name: string) Membership (Mem_no: integer, cust_no: integer)
Cassette (cass_no:integer, cass_name:string, Language: String) Iss_rec(iss_no: integer, iss_date: date, mem_no: integer, cass_no: integer)For the above schema, perform the following–

a. Create the tables with the appropriate integrity constraints
b. Insert around 10 records in each of the tables
c. List all the customer names with their membership numbers
d. List all the issues for the current date with the customer names and cassette names
e. List the details of the customer who has borrowed the cassette whose title is " The Legend"
f. Give a count of how many cassettes have been borrowed by each customer
g. Give a list of books which has been taken by the student with mem_no as 5
h. List the cassettes issues for today

i. Create a view which lists outs the iss_no, iss_date, cust_name, cass_name
j. Create a view which lists issues-date wise for the last one week

Week 6

5. Database Schema for a student-Lab scenarioClass (class_no: string,descrip: string)
Student (stud_no: integer, stud_name: string, class_no: string) Lab (mach_no: integer, Lab_no: integer, description: String)
Allotment (Stud_no: Integer, mach_no: integer, dayof week: string)

For the above schema, perform the following:

a. Create the tables with the appropriate integrity constraints
b. Insert around 10 records in each of the tables
c. List all the machine allotments with the student names, lab and machine numbers
d. List the total number of lab allotments day wise
e. Give a count of how many machines have been allocated to the 'CSIT' class
f. Give a machine allotment etails of the stud_no 5 with his personal and class details
g. Count for how many machines have been allocatedinLab_no1 for the day of the week as "Monday"
h. How many students class wise have allocated machines in the labs
i. Create a view which lists out the stud_no, stud_name, mach_no, lab_no, dayofweek
j. Create a view which lists the machine allotment details for "Thursday".

Week 7

6. Write a program to find the largest number from the given three numbers.
7. Simple programs using loop, while and for iterative control statements.
8. Write a program to check whether the given number is Armstrong or not
9. Write a program to generate all prime numbers below 100.

Week 8

10. Write a program to demonstrate the GOTO statement.
11. Write a program to demonstrate %type and %row type attributes

Week 9

12. Write a program to demonstrate predefined exceptions
13. Write a program to demonstrate user defined exceptions
14. Create a cursor, which displays all employee numbers and names from the EMP table.

Week 10

15. Create a cursor, which update the salaries of all employees who works in deptno 10.
16. Create a cursor, which displays names of employees having salary > 50000.

Week 11

17. Create a procedure to find reverse of a given number
18. Create a procedure to update the salaries of all employees whose salary is between 25000 to50000

Week 12

19. Create a procedure to demonstrate IN, OUT and INOUT parameters
20. Create a function to check whether a given string is palindrome or not.

Week 13

21. Create a function to find the sum of salaries of all employees working in depart number 10.
22. Create a trigger before/after update on the employee table for each row/statement.

Week 14

23. Create a trigger before/after delete on the employee table for each row/statement.
24. Create a trigger before/after insert on the employee table for each row/statement.

Week 15

Review

Text Book

1. Ivan Bayross, SQL, PL/SQL, The programming Language of Oracle, 3rd Revised Edition, BPB Publications, 2008.

Note: The above experiments are for indicative purposes only. However, the concerned faculty member can add a few more experiments in addition to the existing. In such cases the concerned faculty member should get the syllabus approved by the BoS.

M.Sc. I YEAR II SEMESTER

M.Sc. I Year – II Semester

S. No.	Course Code	Category	Course	Max Marks		Hours Per Week			Credits
				I	E	L	T	P	
1	MS201	PC	Core Java Programming	30	70	3	1	0	4
2	MS202	PC	Data Structures	30	70	3	1	0	4
3	MS203	PC	Big Data Frameworks	30	70	3	1	0	4
4	MS204A	PE-I	1. Cyber Security Fundamentals	30	70	3	1	0	4
	MS204B		2. Software Engineering						
	MS204C		3. Data Science						
5	MS205	HS	Digital Well Being	100	-	2	0	0	2
6	MS206	PC-Lab	Core Java Programming Lab	30	70	0	0	6	3
7	MS207	PC-Lab	Data Structures Lab	30	70	0	0	6	3
8	MS208	MC	Cloud Computing Fundamentals	-	-	-	-	-	-
			TOTAL	**280**	**420**	**18**	**4**	**12**	**24**

*Students must be completed certification course

PC : Program Course : MC Mandatory Course HS: Humanities : PE : Professional Elective

Core Java Programming						M.Sc. 1st year 2nd semester		
Code	Category	Hours / Week			Credits	Marks		
MS201	PC	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Course Objectives

Course Objectives of Object-Oriented Programming are to:

1. Impart knowledge of core language features of Java
2. Appraise the concepts of Inheritance and Packages
3. Elaborate the use of Exceptions and collection frameworks in Java
4. Familiarize Event Handling and Applets
5. Emphasize GUI based application development

Course Outcomes

At the end of this Object-Oriented Programming course, students will be able to:

1. Appraise the basic concepts of java
2. Implement inheritance and polymorphism
3. Identify usage of collection framework and build multi-threaded applications
4. Design Applets by using Event Handling features
5. Implement Graphical User Interface applications using Swings

UNIT I

Java Basics: History of Java, Java buzzwords, data types, variables, scope and lifetime of variables,arrays, operators, expressions, control statements, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, static keyword, Garbage collection, Overloading methods and constructors, parameter passing.

UNIT II

Inheritance: Introduction, forms of inheritance- specialization, specification, construction, extension, limitation, combination, Member access rules, super uses, using final with inheritance.

Polymorphism: Method overriding, Abstract classes, Object class

Packages and Interfaces: Defining, Creating and Accessing a Package, importing packages, differencesbetween classes and interfaces, File, Byte Streams, Character Streams

UNIT III

Exception Handling - Concepts of exception handling, exception hierarchy, usage of try, catch, throw,throws and finally, built in exceptions, creating own exception subclasses.

Package java.util- The Collection Interfaces, The Collection classes: LinkedList Class, HashSet Class. TreeSet Class, String Tokenizer, Date, Random, Scanner.

Multi-Threading: Differences between multithreading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.

UNIT IV

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handlingmouse and keyboard events, Adapter classes.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, create applets, passing parameters to applets.

UNIT V

GUI Programming with Swing – Introduction, limitations of AWT, MVC architecture, components, containers. Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout, Gridbaglayout. Creating a Swing Applet, Painting in Swing, A Paint example, Exploring Swing Controls- JLabel and ImageIcon, JTextField, The Swing Buttons,JButton, JToggleButton, JCheckBox, JRadioButton, JTabbedPane, JScrollPane, JList, JComboBox, Swing Menus, Dialogs.

Text Book

1. Herbert Schildt, Java - The Complete Reference, Seventh edition, Tata McGraw Hill, 2006.

Reference Books

1. Bruce Eckel, Thinking in Java, Fourth Edition, Prentice Hall, 2006.
2. Y. Daniel Liang, Introduction to Java programming, Tenth Edition, Pearson education, 2014.

Data Structures						M.Sc.1st year 2nd semester		
Code	Category	Hours / Week			Credits	MARKS		
		L	T	P	C	Internal	End Exam	Total
MS202	PC	3	1	0	4	30	70	100

Course Objectives

Course Objectives of Data Structures are to:

1. Appraise the fundamental concepts of data structures and their representations
2. Describe the applications of non-linear data structures
3. Summarize the concepts of Advanced Trees
4. Discuss the implementation of various Graph representations and traversals
5. Outline the basic concepts of Hashing and Collision resolution Techniques

Course Outcomes

At the end of this Data Structures course, students will be able to:

1. Summarize Static and Dynamic data structures in implementing Stack applications
2. Implement Tree traversal algorithms in solving real time applications
3. Analyze the concepts of Advanced Trees to generate search efficiently
4. Interpret the importance of Graphs in solving real time applications
5. Apply the concepts of hashing

UNIT I

Introduction: What is data structure, Types of data structures, Static and Dynamic representation of data structure and comparison. Stacks-Definition, Operations, Implementation of stacks using arrays, Applications of stacks – Representation and evaluation of expressions using Infix, Prefix and Postfix, Algorithms for conversions and evaluations of expressions from infix to prefix and postfix using stack, Towers of Hanoi, Parenthesis checker.

Queues- Definition, Operations, Implementation of queues using arrays, Applications of queues

UNIT II

Linked Lists: Introduction to Linked List, Operations on Single Linked List (search, Insertion &Deletion)

Trees: Basic terminology, Types of trees: Binary Tree: terminology, Complete and Full Binary Tree, Extended Binary Trees, Threaded Binary Trees-Inorder Threading. Representation of Trees using Arrays and Linked lists (advantages and disadvantages). Tree Traversal and Representation of Algebraic expressions; Algorithms for Tree Traversals. Heaps: Introduction, Types of Heaps – Min binary heap, Max binary heap.

UNIT III

Advanced concepts on Trees: Representation and Creation of Binary Search Trees (BST), Algorithm for inserting, deleting and searching in BST. Representation and advantages of AVL Trees, Algorithms on AVL Trees-Insertion, Rotation and Deletion. Definition and advantages of B-trees, B Tree of Order M, operations- Insertion and Searching, Introduction to Red-Black Trees and Splay Trees.

UNIT IV

Graphs: Basic terminology, Representation of Graphs: sequential representation (Adjacency, Path Matrix) Linked representation.
Graph Traversals-Breadth First Search, Depth First Search with algorithms. Definition and properties of Spanning Tree, Minimum Spanning Tree, Minimum Spanning Tree Algorithms, Dijkstra Algorithms.

UNIT V

Hashing: General Idea, Hash Functions, Collision Resolution- Separate Chaining, Open Addressing-Linear probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing, Implementation of Dictionaries.

Text Book

1. Richard F.Gillberg & Behrouz A. Forouzan, Data Structures, A Pseudo code Approach with C, SecondEdition, Cengage Learning, India Edition, 2005

Reference Books

1. Seymour Lipschutz, Schaum's Outlines, Data Structures, Special Second Edition, Tata McGraw-Hill,2014.
2. Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein, Data Structures Using C andC++, PHI Learning Private Limited, Delhi India, 2001.
3. Horowitz and Sahani, Fundamentals of Data Structures, Galgotia Publications Pvt Ltd. Delhi India,2015.
4. A.K. Sharma, Data Structure Using C, Pearson Education India, 2011

Big Data Frameworks						M.Sc. 1st year 2nd semester		
Code	Category	Hours / Week			Credits	Marks		
MS203	PC	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Course Objectives

Course Objectives of Big Data Frameworks are to:

1. To understand the need of Big Data, challenges and different analytical architectures
2. Installation and understanding of Hadoop Architecture and its ecosystems
3. Processing of Big Data with Advanced architectures like Spark.

Course Outcomes

At the end of this Big Data Frameworks course, students will be able to :

1. Discuss the challenges and their solutions in Big Data
2. Understand and work on Hadoop Framework and eco systems.
3. Explain and Analyse the Big Data using Map-reduce programming in Both Hadoop and Spark framework.
4. Demonstrate spark programming with different programming languages

UNIT I

Introduction To Big Data: Characteristics of Big Data, Traits of Big data, Challenges of Conventional Systems, Sources of Big Data, Applications of big data, Features and benefits of big data, Analysis vs Reporting, CAP theorem, Modern Data Analytic Tools.

UNIT II

Introduction To Hadoop: History of Hadoop, Data Storage and Analysis, Hadoop –Setup, Hadoop operation modes, Configurations of Hadoop. Hadoop Distributed File System, HDFS Architecture, concepts of Blocks in HDFS Architecture, Name Nodes and Data Nodes, using command Line Interface with HDFS, HDFS Commands, Features of HDFS

UNIT III

MapReduce Applications: MapReduce workflows, unit tests with MR Unit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic MapReduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

UNIT IV

Introduction to Hadoop ecosystem technologies: Serialization: AVRO, Co-ordination: Zookeeper, Databases: HBase, Hive, Scripting language: Pig, Streaming: Flink, Storm.

UNIT V

Introduction to GPU Computing, CUDA Programming Model, CUDA API, Simple Matrix, Multiplication in CUDA, CUDA Memory Model, Shared Memory Matrix Multiplication, Additional CUDA API Features. Spark Programming in Scala, SQL Context – Importing and Saving data – Data frames – using SQL –

Text Book

1. Mike Frampton, "Mastering Apache Spark", Packt Publishing, 2015.
2. TomWhite,"Hadoop:TheDefinitiveGuide",O'Reilly,4thEdition,2015.

Reference Books

1. Chris Eaton, Dirk De Roos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data:
2. Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill Publishing, 2012
3. NickPentreath,MachineLearningwithSpark,PacktPublishing,2015.
4. Mohammed Guller, Big Data Analytics with Spark, Apress,2015
5. Donald Miner, Adam Shook, "Map Reduce Design Pattern", O'Reilly, 2012

Cyber Security Fundamentals						M.Sc. 1st year 2nd semester		
Code	Category	Hours / Week			Credits	Marks		
MS204A	PE-I	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Course Objectives

Course Objectives of Fundamentals of Cyber Security are to:

1. Summarize major types of cyber-attacks.
2. Discuss computer malware programs and their impact on the world.
3. Elaborate firewall and password management.
4. Describe major cyber-security prevention mechanisms.
5. Outline Cyber-Security aspects of wireless networks and routers.

Course Outcomes

At the end of this Fundamentals of Cyber Security course, students will be able to:

1. Analyze the cyber security needs of an organization.
2. Design operational and strategic cyber security strategies and policies.
3. Demonstrate various network security applications.
4. Analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
5. Design and develop a security architecture for an organization.

UNIT I

Introduction to Cyber Security Basics, Importance of Cyber Security, Cyber- attacks, objectives of cyber- attacks, Types of Cyber-attacks, Denial of Service (DoS), Distributed Denial of Service (DDoS), Man-in- the-Middle (MITM) Attacks, Crypto jacking, SQL Injection, Spamming, Cyber-terrorism, Digital Property Misappropriation, zero-day exploitation, phishing, digital vandalism, cyber-stalking, cyber frauds and forgery.

UNIT II

Introduction to Cyber-attacks and their impact, Equifax Data Theft, VPNFilter Cyber- attack, WannaCry Ransom Attack, Peta Cyber-attack, US Election Manipulation, Power Grid Hacking, Shadow Networkattack, GitHub DDoS Attack, Under Armor Account Hacking, Types of Computer Malware, Viruses, Trojan Horse, Rootkit, Spyware, Worms, Adware, Scare-ware, Browser Hijacker.

UNIT III

Introduction to Computer Security, Firewall Settings, Antivirus Software, Anti-Spyware Software, Anti- Spam Software, Security Updates, Secure Browsing Settings, Scan Devices before Data Transfer, Social Engineering Attack Precautions. Password Management, Basics of Passwords, Threats to Passwords, Good and Bad about Passwords, Hacking Password, Effective Password Management, Creating and Managing Secure Passwords, Strong Password, Use of Biometrics, Two-Factor Authentication, Multi- Factor Authentication, Password Manager Tools.

UNIT IV

Prevention from Cyber-attacks, Algorithms and Techniques, Cyber-attack Detection, Cyber-attack Prediction, Cyber-attack Prevention , Firewalls, Activating Windows Firewall, Windows 10 firewall, Windows 7 firewall, Enabling Windows 7 firewall, Enabling Windows firewall service, Traffic Issues and rules , firewall settings, Intrusion Detection/Prevention Systems, Intrusion Detection System (IDS) , Intrusion Prevention System (IPS),,Authentication Using Hash, Message Digest , Secure Hash Algorithm ., Multi-Factor Authentication, Activating Two-Factor Authentication, Creating Application SpecificPasswords , What If Your Phone with All Apps Enabled Is Lost?, Mac Computer Firewall Configuration, Virtual Private Network.

UNIT V

Introduction to Wireless Security, LAN Vulnerabilities, Reconnaissance Vulnerability, Resource Stealing and Invasion, Rogue Access Points (APs), STA and AP Plain Text Transaction, Denial of Service (DoS),Default AP Configuration, Rogue Insiders, Protocol Vulnerabilities, Ad Hoc Network Mode Security Problems ,Wireless WAN Vulnerabilities ,IoT Vulnerabilities, Wireless Network Security Measures, Modify Default Configuration, Wireless Router Location, Update Router Software, Stronger Encryption Algorithms, MAC Address Filtering ,Useful Tips on Safe Use of Wireless Network.

Text Book

1. Dr Kutub Thakur Dr Al-Sakib Khan Pathan, Cyber-security Fundamentals Real-World Perspective, firstedition published 2020 by CRC Press, © 2020 Taylor & Francis Group, LLC.

Reference Books

1. Rajkumar Singh Rathore, Aatif Jamshed, Mayank Bhusan, Fundamental of Cyber Security Principles and Theory and Practices, BPB Publications, 01-Jun-2018.
2. J. Pieprzyk, T. Hardjono and J. Seberry, Fundamentals of computer security, Springer, 2003.

Software Engineering						M.Sc. 1st year 2nd semester		
Code	Category	Hours / Week			Credits	MARKS		
		L	T	P	C	Internal	End Exam	Total
MS204B	PE-I	3	1	0	4	30	70	100

Course Objectives

Course Objectives are to:

1. Identify an appropriate Process Model.
2. Deliberate Software Requirements-functional and nonfunctional.
3. Design various system models for a given scenario.
4. Elaborate about different testing techniques.
5. Describe role of risk management in Software Engineering.

Course Outcomes

At the end of this course, students will be able to:

1. Analyze process models.
2. Emphasize Software Requirements -functional and nonfunctional.
3. Appreciate the system models.
4. Compare and contrast various testing techniques.
5. Identify various risk strategies

UNIT I

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths. A Generic view of process: Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI).
Process models: The waterfall model, Incremental process models, Evolutionary process model. [TB:1, CH:1,2,3]

UNIT II

Agile process Model: Agile principles, Extreme programming, Dynamic System Development Methods, Feature Driven Development, Scrum framework, Sprint, Scrum master, Roles of Scrum Master, Implementing Scrum - A case study. [TB:1, CH:4]

Software Requirements: Functional and non-functional requirements, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. [TB:2, CH:6,7]

UNIT III

System Models: Context Models, Behavioral models, Data models, Object models, structured methods. [TB:2, CH:8]

Design Engineering: Design process and Design quality, Design concepts, the design model. Modeling component level design: design class-based components, conducting component level design. Performing User interface design: Golden rules. [TB:1, CH:9,11]

UNIT IV

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing.

Product metrics: Software Quality, Metrics for Analysis Model- function based metrics, Metrics for Design Model-object oriented metrics, class-oriented metrics, component design metrics, Metrics for source code, Metrics for maintenance. [TB:1, CH:13,14,15]

UNIT V

Risk Management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.

Quality Management: Quality concepts, Metrics for Software Quality, Software Reviews, Formal Technical Reviews, Software Reliability, The ISO 9000 quality standards. [TB:1, CH:25, 26]

Text Books

1. Roger S. Pressman, Software Engineering - A practitioner‘s Approach, 6th edition. McGraw Hill International Edition, 2005.
2. Somerville, Software Engineering, 7th Edition, Pearson Education, 2009.

Reference Books

1. K.K. Agarwal & Yogesh Singh, Software Engineering, New Age International Publishers,3rd edition,2008
2. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House, 3rd edition,2005.
3. James F. Peters, Witold Pedrycz, Software Engineering - an Engineering approach, JohnWiely, 2007.
4. Waman S Jawadekar, Software Engineering Principles and Practice, The McGraw-Hill Companies,2013.
5. https://nptel.ac.in/courses/106/105/106105182/

Data Science						M.Sc.1st year 2nd semester		
Code	Category	Hours / Week			Credits	Marks		
MS204C	PE-I	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Course Objectives

Course Objectives are to:

1. Summarize the concepts of Data science
2. Outline various steps involved in Data science
3. Discuss data collection and manipulation methods in Data science
4. Describe how to handle categorical and time series data
5. Compare various methodologies in data visualization

Course Outcomes

At the end of this course, students will be able to:

1. Discuss data science concepts and Process
2. Handle large data in Single Computer
3. Manipulate large data using Python Programming language
4. Analyze large categorical and time series data
5. Create dashboards to display the data using visualization

UNIT I

Data science in a Big Data World: Benefits and uses of data science and big Data-Facets of data-The data science process-The big data ecosystem and data science. The data science process-Overview of the data science process-Steps: Defining research goals and creating-- Retrieving data. [TB:1, CH:1]

UNIT II

Handling Large Data on a Single Computer: The problem in handling large data-General techniques for handling large volumes of data-General programming tips for dealing with large data sets-Case Studies. [TB:1, CH:2,4]

UNIT III

Data Manipulation with Pandas: Introducing Pandas Objects- Data Indexing and Selection- Operating on Data in Pandas- Handling Missing Data- Hierarchical Indexing- Combining Datasets: Concat and Append- Combining Datasets: Merge and Join- Aggregation and Grouping. [TB:2, CH:3]

UNIT IV

Data Manipulation with Pandas: Pivot Tables- Vectorized String Operations- Working with Time Series- High-Performance Pandas: eval () and query (). [TB:2, CH:3]

UNIT V

Visualization with Matplotlib: Simple Line Plots- Simple Scatter Plots- Visualizing Errors- Density and Contour Plots- Histograms, Binnings, and Density- Customizing Plot Legends- Customizing Colorbars- Multiple Subplots- Text and Annotation- Customizing Ticks- Customizing Matplotlib: Configurations and Stylesheets- Three- Dimensional Plotting in Matplotlib- Geographic Data with Basemap. [TB:2, CH:4]

Text Books

1. Davy Cielen, Arno d. B. Meysman, Mohamed Ali, Introduction to Data Science, Manning Publications,2016.
2. Jake Vanderplas, Python Data science Hand Book, O'Reilly, 2017.

Reference Books

1. Cathy O'neil, Rachel Schutt, Doing Data Science, straight talk from the frontline, O'Reilly, 2013
2. Jure Leskovek, Anand Rajaraman, Jeffry Ullman, Mining of Massive datasets, V2.1, Cambridge University Press, 2014.
3. Joel Grus, Data Science from Scratch: First Principles with Python, first edition, O'Reilly, 2015.

Web References

1. An introduction to data science https://www.edureka.co/blog/what-is-data-science/ https://intellipaat.com/blog/what-is-data-science/
2. Data collection: http://bigdata-madesimple.com/3-effective-methods-of-data-collection-for-market-research/
3. Data sources: https://www.allerin.com/blog/top-5-sources-of-big-data

http://tdan.com/combining-data-from-multiple-sources-join-integrate-blend/19877
https://www.techrepublic.com/blog/big-data-analytics/use-normalization-and-etl-to-get-the-big-data-results-you-want/
https://www.youtube.com/watch?v=f0nMfV1GvOg

Digital Well Being						M.Sc. 1st year 2nd semester		
Code	Category	Hours / Week			Credits			
MS205	PC	L	T	P	C	Internal	End Exam	Total
		2	0	0	2	-	-	100

Digital Wellbeing – Credit Course

(Teaching + Case Studies & Co-Curricular Activities)

(Note: Course can a self-study and we can provide video recordings)

Course Objectives:

To create awareness of digital wellbeing among students and fellow citizens regarding digital wellbeing by educating them in various kinds of frauds, threats and attacks in digital world along with their basic counter measures.

Course Outcomes:

By the end of the course, students will be

1. *Able to gain knowledge regarding cybercrimes and cyber offenses*
2. *Able to know how to uncover fake news and how to protect online data*
3. *Able to understand cyber bullying, and its counter measures, social media management along with Digital Parenting*
4. *Able to gain knowledge in Digital Legal and Ethical Issues*
5. *Able to analyse various case studies*

UNIT – I Introduction to Digital Wellbeing ***00.30 Hrs***

a) *Introduction to Digital Wellbeing*

UNIT – II ***Digital Security Tools and Techniques*** ***01:30 Hrs***

b) *Uncovering fake news, Is Privacy is a Myth?*

c) *Consent & Data Why is it different online.*

d) *Uncovering Fake News*

UNIT - III ***Digital Safety – Physical & Psychological Wellbeing*** ***01:30Hrs***

e) *Cyber bullying,*

f) *Digital Parenting,*

g) *Digital Addiction,*

UNIT – IV Digital Spirit – Legal and Ethical Issues 01:30 3Hrs

h) Cyber Crime against Women and Children,

i) Managing Negative Comments Online,

j) Social Engineering Crimes

k) Digital Intelligence (Tips on Safety)

UNIT – V Case Studies 04:00 Hrs

Case Studies (Mini Cases Example): State of Tamil Nadu vs. Suhas Katti Case, The Slumdog Millionaire Movie Piracy case, Cyber Pornography involving a Juvenile Criminal, Pune Citibank Mphasis call Center fraud, Swedish case of hacking and theft of trade secrets, Indian case of Cybersquatting and different varieties of Social Engineering Crimes and their modus operandi. (Or Any Case Study of Students Choice , A minimum of two case studies each 2000 word document)

Text Books:

1. *Cyber Security : Understanding Cyber Crimes, Computer Forensics ad Legal Perspectives – Nina Godbole – Sunit Belapure. Wiley India -2014.(Unit I, V)*
2. *Uncovering Fake News : ISBN : 978-81-946731-0-1*
3. *Is Privacy is a Myth? : ISBN: 978-81-946731-4-9*
4. *Consent & Data Why is it Different Online? :ISBN: 978-81-946731-6-3*
5. *Cyberbullying : ISBN: 978-81-946731-1-8*
6. *Digital Parenting : ISBN: 978-81-946731-7-0*
7. *Digital Addiction : ISBN: 978-81-946731-8-7*
8. *Cyber Crime Against Women and Children : ISBN : 978-81-946731-2-5*
9. *Managing Online Negative Comments : ISBN: 978-81-946731-5-6*

Co – Curricular Activities:

Students shall perform co-curricular activities like assignments, conducting seminars in government schools, colleges and also in neighbourhood, group discussions, etc.

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Core Java Programming Lab						M.Sc. 1st year 2nd semester		
Code	Category	Hours / Week			Credits	Marks		
MS206	PC-Lab	L	T	P	C	Internal	End Exam	Total
		0	0	6	3	30	70	100

Course Outcomes

At the end of this Java Programming Lab course, students will be able to:

1. Implement simple Java Programs
2. Develop the programs using interfaces and packages
3. Demonstrate the use of threads and Exception handling
4. Design Applet programs
5. Develop GUI applications using Swings

List of Experiments

Week 1

1. Write a Java Program to define a class, define instance methods for setting and retrieving values of instance variables and instantiate its object
2. Demonstrate the use of static keyword and this keyword.

Week 2

1. Write a program to illustrate types of constructors and constructor overloading
2. Write a Java program to demonstrate the use of String class and its methods.

Week 3

1. Write a program to illustrate parameter passing Techniques
2. Write a java program to illustrate Recursion and nested class

Week 4

1. Write a program to demonstrate the use of inheritance.
2. Write a java program to demonstrate the concept of polymorphism.

Week 5

1. Write a program to illustrate Files.
2. Demonstrate the use of I/O Streams.

Week 6

1. Write a program to illustrate the use of packages.
2. Write a program to illustrate Interfaces.

Week 7

1. Write a program to illustrate try, catch, throw, throws and finally keywords
2. Write a program to implement the concept of User defined Exceptions.

Week 8

1. Write a program to illustrate Multithreading.
2. Write a program to illustrate thread priorities.

Week 9

1. Write a program to illustrate Thread Synchronization.
2. Write a program to illustrate Inter Thread Communication.

Week 10

1. Write a program to illustrate collection classes and interfaces.
2. Write a program to illustrate String Tokenizer, Date, Random and Scanner classes.
3. Write a program to illustrate Event Handling (keyboard, Mouse events).

Week 11

1. Develop an applet in Java that displays a simple message.
2. Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked.

Week 12

1. Write a program to develop a calculator application using Swings.

Week 13

Review.

Data Structures Lab						M.Sc. 1st year 2nd semester		
Code	Category	Hours / Week			Credits	MARKS		
MS207	PC-Lab	L	T	P	C	Internal	End Exam	Total
		0	0	6	3	30	70	100

Course Outcomes

At the end of this Data Structures Lab course, students will be able to:

1. Develop the programs on stacks and its applications
2. Demonstrate the operations on Trees
3. Code the implementation of various advanced trees
4. Design and implementation of programs on BST and Graph Traversals
5. Develop the programs on Hashing and Dictionaries

Week 1

1. Program to implement Stack Operations using arrays and Linked Lists
2. Program to implement Queue Operations using arrays and Linked Lists

Week 2

1. Program to convert infix to postfix notation
2. Program to evaluate postfix notations

Week 3

1. Program to implement towers of Hanoi
2. Program to implement parenthesis checker

Week 4

1. Program to implement Single linked list

Week 5

1. Program to illustrate tree traversals
   a) In order b) Preorder c) Post order

Week 6

1. Program to illustrate insertion, deletion and searching in Binary Search Tree

Week 7

1. Program to implement Heaps

a) Min Heap b) Max Heap

Week 8

1. Program to illustrate Insertion on AVL Trees
2. Program to illustrate deletion and Rotation on AVL Trees

Week 9

1. Program to illustrate Graph traversals
   a) Breadth First Search
   b) Depth First Search

Week 10

1. Program to implement

a) Prim's algorithm b) Kruskal's algorithm

Week 11

1. Program to Implement Dijkstra algorithm

Week 12

1. Program to implement Hashing and collision resolution techniques

Week 13

1. Program to implement Dictionaries

Week 14

Internal Assessment

Note: The above experiments are for indicative purposes only. However, the concerned faculty member can add a few more experiments in addition to the existing. In such cases the concerned faculty member should get the syllabus approved by the BoS.

M.Sc. 1st year 2nd semester

MS208: MC: MOOCs Course: **Cloud Computing Fundamentals**

Note: Students are evaluated based on the certification course they have Undergone during the semester. The courses need to be registered under the university recognized organizations and domains. This is mandatory course.

Note: All the MSc (Computer Science) students are mandatory for MOOC's Course. But MOOC's course has no syllabus.

M.Sc. II Year – III Semester

S. No.	Course Code	Category	Course	Max Marks		Hours Per Week			Credits
				I	E	L	T	P	
1	MS301	PC	Advance Java Programming	30	70	3	1	0	4
2	MS302	PC	Machine Learning	30	70	3	1	0	4
3	MS303	PC	R Programming	30	70	3	1	0	4
4	MS304	PE-II	1. Operating System (OS)	30	70	3	1	0	4
	MS305		2. Cyber Law						
	MS306		3. Cryptography & Network Security						
5	MS307	PC-Lab	Advance Java Programming Lab	30	70	0	0	6	3
6	MS308	PC-Lab	Machine Learning Lab	30	70	0	0	6	3
7	MS309	PC-Lab	R Programming Lab	100	-	0	0	6	3
8	MS310	MC	Deep Learning	-	-	0	0	0	0
			Total	**280**	**420**	**12**	**4**	**18**	**25**

Advanced Java Programming					M.Sc. 2nd year 1st semester			
Code	Category	Hours / Week			Credits	MARKS		
MS301	PC	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Learning Objective (LO):

LO1	Design and develop Web applications
LO2	Create web pages using HTML, DHTML and Cascading Styles sheets.
LO3	Analyze and build interactive web applications using JSP and Servlets.
LO4	Design and develop Web applications
LO5	Designing Enterprise based applications by encapsulating an application's business logic

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Explain the technologies used in web applications.	K1
CO2	Demonstrate HTML5, CSS, JavaScript coding for web applications	K2
CO3	Design creative websites using object based scripting concepts	K6
CO4	Learn to access database through Java programs, using Java Data Base Connectivity (JDBC)	K1
CO5	Create dynamic web pages, using Servlets and JSP	K6

UNIT I

HTML common Tags List, Tables, images, forms, Frames, Cascading Style Sheets; **Java ScriptIntroduction** to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script.

Learning Outcomes
Students upon completion of this unit will be able to

- Develop a dynamic webpage by the use of java script and DHTML.
- Design a responsive web site using HTML and CSS.

UNIT II

XML-Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML ProcessorsDOM and SAX
CGI Scripting- What is CGI? – Developing CGI applications – Processing CGI – Returning a Basic HTML page – Introduction to CGI.pm – CGI.pm methods – Creating HTML pages dynamically.

Learning Outcomes
Students upon completion of this unit will be able to

- Write a well formed / valid XML document
- Developing CGI applications

UNIT III

JDBC Introduction to JDBC – Connections – Internal Database Connections – Statements – Results Sets - Prepared Statements - Callable Statements.

Network Programming and RMIwhy networked Java – Basic Network Concepts – looking up Internet Addresses – URLs and URIs – UDP Datagram's and Sockets – Remote Method Invocation.

Learning Outcomes
Students upon completion of this unit will be able to

- Design to create structure of web page, to store the data in web document, and transport information through web.
- Establish the Connection between Java Application and database to insert, retrieve and modify the data in tables.

UNIT –IV

Web Servers, Tomcat web server, Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat, Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat.

Servlets
Introduction to ServletsLifecycle of a Servlet, JSDK, The Servlet API, The javax.servlet Package, Reading Servlet parameters, Reading Initialization parameters. The javax.servlet HTTP package,Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues.

Learning Outcomes
Students upon completion of this unit will be able to

- Install Tomcat Server and execution of programs on server side.
- How to work with the Servlet.

UNIT-V

Introduction to JSP The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment

Learning Outcomes
Students upon completion of this unit will be able to

- Identify the problems in Servlets and overcome those using Java Server Pages
- Develop JSP applications with Model View Control architecture.

Prescribed Textbooks

1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech (units I, II)
2. Java Programming with JDBC ;Donald Bales, O'Reilly (Unit III)
3. Java Network Programming, elliotte Rusty Harold, 3rd Edition, O'Reilly (Unit III)
4. Java Server Pages – Hans Bergsten, SPD O'Reilly (Unit IV)

Reference Textbooks

1. Robert W. Sebesta, "Programming the World Wide Web", Third Edition, Pearson Education (2007).
2. Anders Moller and Michael schwartzbach, "An Introduction to XML and Web Technologies", Addison Wesley (2006)
3. Jeffrey C. Jackson, "Web Technologies – A Computer Science Perspective", Pearson Education (2008).
4. H.M.Deitel, P.J.Deitel, "Java How to Program", Sixth Edition, Pearson Education (2007).

Machine Learning					M.Sc. 2nd year 1st semester			
Code	Category	Hours / Week			Credits	MARKS		
MS302	PC	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Learning Objectives (LO):
The course is designed to meet the objectives of:

LO1	To introduce to the students the basic concepts and fundamentals of machine learning
LO2	To develop skills of implementing machine learning techniques
LO3	To familiarize the students with latest technologies
LO4	To implement machine learning solutions to classification, regression
LO5	To implement machine learning algorithms for clustering

Course Outcomes (CO):
Students successfully completing this module will be able to:

CO1	How to make a computer program learn from experience	K1
CO2	Illustrate the significance of concept learning	K2
CO3	Representation of decisions and decision making explicitly	K5
CO4	Construct finite and infinite Hypothesis spaces for computational learning	K3
CO5	Apply Inductive and Analytical learning in developing learning tasks	K3

UNIT – I

Introduction - Well-posed learning problems, Designing a learning system, Perspectives and issuesin machine learning
Concept learning and the General to Specific Ordering – Introduction, A concept learning task, Concept learning as search, Find-S finding a maximally specific hypothesis, Version spaces and the Candidate-Elimination algorithm, Remarks on version spaces and Candidate-Elimination, Inductive Bias**Learning Outcomes**

Students acquire knowledge about

1. How to make a computer program to learn from experience
2. Importance of concept learning

UNIT – II

Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning
Evaluation Hypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms
Students acquire knowledge about

1. Representation of decisions and decision making explicitly
2. To come to a conclusion from the observations about an item
3. Prediction of probabilities

UNIT-III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm

Students acquire knowledge about

4. To know Bayes Therom
5. To classify the data using different algorithms

UNIT-IV

Computational learning theory – Introduction, Probability Learning an Approximately Correct Hypothesis, Sample Complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The Mistake Bound Model of Learning
Instance-Based Learning- Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning

Students develop in-depth understanding of

1. Different learning theories
2. The methods to categorize and organize information

Unit- V

Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis SpaceSearch, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms
Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators
Reinforcement Learning – Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

Learning Outcomes

Students acquire knowledge about

1. Generation of solutions to optimization and search problems
2. Different kinds of learning techniques
3. Describing the set of learning problems

TEXT BOOKS

- Machine Learning – Tom M. Mitchell, - MGH

REFERENCE BOOKS

- Introduction to Machine Learning,- Ethem Alpaydin, - PHI
- Machine Learning An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

R Programming					M.Sc. 2nd year 1st semester			
Code	Category	Hours / Week			Credits	MARKS		
MS303	PC	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Learning Objective (LO):

LO1	The basics of statistical computing and data analysis
LO2	How to implement data structure in R
LO3	R loop functions and debugging tools
LO4	Lists and Vectors concepts in R
LO5	Factors and levels in R

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Explain critical R programming concepts	K2
CO2	Demonstrate how to install and configure RStudio	K2
CO3	Apply OOP concepts in R programming	K3
CO4	Explain the use of data structure and loop functions	K2
CO5	Apply various concepts to write programs in R	K3

UNIT I

Introduction : Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

UNIT II

Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes.

UNIT III

Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and DeletingVector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations

UNIT IV

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix- Like Operations

UNIT V

Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

Prescribed Text Books:

1. Roger D. Peng, “R Programming for Data Science”, 2012

2. Norman Matloff, “The Art of R Programming- A Tour of Statistical Software Design”, 2011

Reference TextBooks:

1. Jared P. Lander, "R for Everyone - advanced analytics andGraphics", 2nd Edition, Addison-Wesley.

2. Paul Teetor, "R Cookbook", 2nd Edition, O'Reilly publications.

3. Garrett Grolemund, Hadley Wickham, “Hands-On Programming with R: Write Your Own Functions and Simulations”, 1st Edition, 2014

Operating Systems					M.Sc. 2nd year 1st semester			
Code	Category	Hours / Week			Credits	MARKS		
MS304A	PE – II	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Objectives
The course is designed to meet the objectives of appreciate
1. Understanding the role of an operating system
2. making aware of the issues in management of resources like processor, memory and input-output
3. Understanding file management techniques.

Outcomes
Students successfully completing this module will be able to
1. Understands what is an operating system and the role it plays
2. Get high level understanding of the structure of operating systems, applications, and the relationship between them
3. Gather knowledge of the services provided by operating systems
4. Get exposure to some details of major OS concepts.

UNIT-I

Introduction : What Operating Systems Do – Computer System Organization – Computer system Architecture – Operating System Structure – Operating System Operations – Process Management – Memory Management – Storage Management – Protection and Security – Distributed Systems – Special purpose Systems – Computing Environments.

System Structure : Operating System Services – User Operating System Interface – System Calls – Types of System Calls – System Programs – Operating System Design and Implementation – Operating System Structure – Virtual Machine – Operating System Generation – System Boot.

Process Concept: Overview – Process Scheduling – Operations on Processes – Inter process Communication – Examples of IPC Systems – Communication in Client Server Systems.

Learning Outcomes
Students upon completion of this unit will be able to
- Analyze the structure of OS and basic architectural components involved in OS design
- Appreciate the role of operating system as System software.
- Demonstrate understanding of the Process.

UNIT-II

Multithreaded Programming : Overview – Multithreading Models – Thread Libraries – Threading Issues – Operating System Examples.

Process Scheduling : Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Multiple Processor Scheduling – Thread Scheduling.

Learning Outcomes
Students upon completion of this unit will be able to

- Understand the uses of Thread and the process of Multi Threading.
- Understand the process management policies and scheduling of processes by CPU

UNIT–III

Synchronization : Background – The Critical Section Problem – Peterson's solution – Synchronization Hardware – Semaphores – Classic Problem of Synchronization – Monitors – Synchronization Examples – Atomic Transaction.

Deadlocks : System Model – Deadlock Characterization – Methods for Handling Deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock.

Learning Outcomes
Students upon completion of this unit will be able to

- Evaluate the requirement for process Synchronization and coordination handled by operating system
- Apply various concept related with Deadlock to solve problems related with Resources allocation, after checking system in Safe state or not.

UNIT–IV

Memory Management Strategies : Background – Swapping – Contiguous Memory Allocation – Paging – Structure of the Page Table – Segmentation – Example The Intel Pentium.

Virtual Memory Management : Background – Demand Paging – Copy on Write – Page Replacement – Allocation of Frames – Thrashing.

Learning Outcomes

- Identify use and evaluate the Memory Management policies with respect to different Memory Management technologies.
- Identify use and evaluate the Virtual Memory Management policies with respect to different Virtual Memory Management techniques.

UNIT–V

File System : File Concept – Access Methods – Directory Structure – File System Mounting – File Sharing – Protection.

Implementing File Systems: File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free Space Management – Efficiency and Performance –Recovery – Log structured File Systems.

Secondary Storage Structure : Overview of Mass Storage Structure – Disk Structure – Disk Attachment – Disk Scheduling – Disk Management – Swap Space Management – RAID structure.

I/O Systems : Overview – I/O Hardware – Application I/O Interface – Kernal I/O Interface – Transforming I/O requests to Hardware Operations – Streams – Performance.

Learning Outcomes
Students upon completion of this unit will be able to

- Compare the various algorithms and comment about performance of various algorithms used for File handling and I/O operations.
- Master issues related to file system interface and implementation, disk management.

Prescribed Book

Abraham Silberschatz, Peter Baer Galvin, Greg Gagne. "Operating System Principles", Seventh Edition, Wiley.

Chapters 1.1 – 1.12, 2.1 – 2.10, 3.1 – 3.6, 4.1 – 4.5, 5.1 – 5.5, 6.1 – 6.9 , 7.1 – 7.7 , 8.1 – 8.7, 9.1 – 9.6, 10.1 – 10.6, 11.1 – 11.8, 12.1 – 12.7, 13.1 – 13.7

Reference Book

1.William Stallings, "Operating Systems – Internals and Design Principles", Fifth Edition, 2.Pearson Education (2007)
3.Achyut S Godbole, "Operating Systems", Second Edition, TMH (2007).
4.Flynn/McHoes, "Operating Systems", Cengage Learning (2008).
5. Deitel & Deitel, "Operating Systems",Third Edition, Pearson Education (2008).

Cyber Laws					M.Sc. 2nd year 1st semester			
Code	Category	Hours / Week			Credits	MARKS		
MS304B	PE – II	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Course Objectives: The objectives of this course is to:

1. Enable learners to understand, explore, and acquire a critical understanding of Cyber Law
2. Develop competencies for dealing with frauds and deceptions (confidence tricks, scams) and other cyber crimes for example, child pornography etc. that are taking place via the Internet.
3. Make learners conversant with the social and intellectual property issues emerging from 'Cyberspace'.
4. Explore the legal and policy developments in various countries to regulate Cyberspace;
5. Develop the understanding of relationship between commerce and cyberspace; and give learners in depth knowledge of Information Technology Act and legal frame work of Right to Privacy, Data Security and Data Protection.

Course outcomes

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

1. Critically evaluate ongoing developments in law relating to information technologies
2. Display an understanding of how these developments relate to one another.
4. Examine areas of doctrinal and political debate surrounding rules and theories;
5. Evaluate those rules and theories in terms of internal coherence and practical outcomes;
6. Draw on the analysis and evaluation contained in primary and secondary sources

UNIT I

Introduction: Computers and its Impact in Society, Overview of Computer and Web Technology, Need for Cyber Law, *Cyber Jurisprudence* at International and Indian Level.

UNIT II

Cyber Law- International Perspectives: UN &International Telecommunication Union (ITU)Initiatives, Council of Europe -Budapest Convention on Cybercrime, Asia-Pacific Economic Cooperation(APEC), Organization for Economic Co-operation and Development(OECD), World Bank, Commonwealth of Nations.

UNIT III

Constitutional& Human Rights Issues in Cyberspace: Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace – Access to Internet, Right to Privacy, Right to Data Protection.

UNIT IV

Cyber Crimes& Legal Framework: Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud, Cyber terrorism, Cyber Defamation, Different offences under IT Act, 2000.

UNIT V

Cyber Torts: Cyber Defamation, Different Types of Civil Wrong sunder the IT Act, 2000, Intellectual Property Issues in Cyber Space, Interface with Copyright Law, Interface with Patent Law, Trade marks & Domain Names Related issues

Reference Books

1. ChrisReed&John Angel,*Computer Law*, OUP,NewYork,(2007).
2. JusticeYatindraSingh,*Cyber Laws*, UniversalLaw PublishingCo, New Delhi, (2012).
3. VermaK,MittalRaman,*LegalDimensionsofCyberSpace*,IndianLawInstitute,NewDelhi,(2004)
4. Jonthan Rosenoer,*Cyber Law*, Springer,New York, (1997).
5. SudhirNaib,TheInformationTechnologyAct,2005:AHandbook,OUP,NewYork,(2011)
7. S.R.Bhansali, *Information TechnologyAct,2000*,UniversityBookHousePvt.Ltd.,Jaipur(2003).
8. Vasu Deva,*Cyber Crimes and Law Enforcement*,CommonwealthPublishers,New Delhi,(2003).

Cryptography & Network Security					M.Sc. 2nd year 1st semester			
Code	Category	Hours / Week			Credits	MARKS		
MS304C	PE – II	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Learning Objective (LO):

LO1	To provide introduction to the concept of Network Security Model and Cryptography systems.
LO2	To give the knowledge of Digital Signature and other Security Measures available.
LO3	To familiarize with the various techniques like PGP and S/MIME.
LO4	To showcase IP Security Architecture & Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks
LO5	To explain the firewall design principles and various intrusion detection system.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Identify and classify particular examples of attacks,
CO2	Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems,
CO3	Describe the use of hash functions and explain the characteristics of one-way and collision-free functions,
CO4	Describe and distinguish between different mechanisms to assure the freshness of a message,
CO5	Explain the role of third-party agents in the provision of authentication services,

UNIT I

Introduction - securityTrends,OSI security Architecture ,security attacks,security services, security mechanisms,A model for network security

Conventional Encryption Classical Techniques - Symmetric cipher model ,substitution techniques ,transposition techniques,rotor machines ,steganography

Conventional Encryption Modern Techniques -Block cipher principles,DES,strength of DES,Differential and linear cryptanalysis ,Block cipher design principles

Learning Outcomes

Students will get knowledge about

1. Different types of attacks
2. Symmetric encryption mechanisms
3. Important Symmetric algorithms

UNIT II

Confidentiality using Symmetric encryption - Placement of encryption function,traffic confidentiality,key distribution,random number generation

Public - key cryptography & RSA - Principles of Public key crypto systems ,RSA algorithm ,Key management ,Diffie Hellman key exchange ,elliptic curve cryptography

Learning Outcomes

Students will develop understanding regarding

1. Asymmetric cryptosystem
2. Encryption using private

UNIT III

Message authentication and Hash functions - Authentication requirements , Authentication functions,Message Authentication codes,Hash functions,Security of MAC's and hash functions

Digital signatures and Authentication Protocols - Digital signatures , Authentication Protocols,DSS

Learning Outcomes

Students acquire knowledge about

1. Various Authentication Services
2. Importance of Message Authentication Codes and digital signatures

UNIT IV

Electronic Mail Security - PGP, S/MIME

IP Security - IP Security Overview, IP Security architecture,Authentication header,encapsulating security payload,combining security associations,key management.

Learning Outcomes

Students will develop understanding regarding

1. Mail Security
2. IP Secrutity

UNIT V

Fire Walls - Firewall design principles ,trusted systems

Learning Outcomes

Students will develop understanding regarding

1. Design principles to develop a firewall
2. Trusted Systems & Bastion Host

Prescribed Book

William Stallings Cryptography & Network Security Principles and Practices 4th Edition Pearson Education

Chapters 1,2,3,7,8,9,10,11,13,15,16,20

Reference Books

Bruce Schneier - Applied Cryptography - Wiley - second edition

Davies & Price Security for computer Networks, Wilsey (1984)

Advanced Java Programming Lab					M.Sc. 2nd year 1st semester			
Code	Category	Hours / Week			Credits	MARKS		
MS305	PC – LAB	L	T	P	C	Internal	End Exam	Total
		0	0	6	3	30	70	100

1. Develop and demonstrate a HTML document that illustrates the use external style sheet, ordered list, table, borders, padding, color, and the tag.

2. Write HTML code to provide intra document linking.

3. Create a form with the following specifications

   a) Our form uses frames, one to hold the links bar at the top of the browser window.
   b) Other is a larger frame that provides the main view.
   c) The links bar should contain 5 links, which when clicked, should display the appropriate HTML file in the larger frame.

4. to create a webpage with the following using html

   a. to embed an image in web page

   b. to fix the hot spots

   c. show all the related information when a hot spot is clicked in the map

5. Develop a HTML Form, which accepts any Mathematical expression. Write JavaScript code to Evaluates the expression and Displays the result.

6. Create a HTML form that has number of Textboxes. When the form runs in the Browser fill the textboxes with data. Write JavaScript code that verifies that all textboxes has been filled. If a textboxes has been left empty, popup an alert indicating which textbox has been left empty.

7. Write a JavaScript code to find the sum of N natural Numbers. (Use user-defined function)

8. Write a JavaScript code to find factorial of N. (Use recursive function)

9. Write a JavaScript code block using arrays and generate the current date in words, this should include the day, month and year.

10. Create a web page using two image files, which switch between one another as the mouse pointer moves over the images. Use the onMouseOver and onMouseOut event handlers.

11. Design an XML document to store information about a student in an engineering college affiliated to ANU. The information must include college id, Name of the College, Brach, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and useit to display the document.

12. Create an XML document, which contains 10 users information. Implement a program, which takes User Id as an input and returns the user details by taking the user information from the XML document
13. write a program for implementing student information using XML
14. write a java program to illustrate java to database connectivity using JDBC
15. Write a program to print the Fibonacci numbers using RMI.
16. Write a program using RMI to access the database using the primary key value and return the data to the client.
17. Write a html program for invoking servlet from applet
18. write a java servlet program to conduct online examination and to display student mark list available in a database
19. Create a java program to create an airline reservation service and a travel agent and the travel agent is searching for an airline using web services and database.
20. Write a JSP program to calculate income tax, login and data capture.

Note: The above experiments are for indicative purposes only. However, the concerned faculty member can add a few more experiments in addition to the existing. In such cases the concerned faculty member should get the syllabus approved by the BoS.

Machine Learning Lab					M.Sc. 2nd year 1st semester			
Code	Category	Hours / Week			Credits	Marks		
MS306	PC – LAB	L	T	P	C	Internal	End Exam	Total
		0	0	6	3	30	70	100

1.	The probability that it is Friday and that a student is absent is 3%. Since there are 5 school days in a week, the probability that it is Friday is 20%. What is theprobability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result.(Ans: 15%)
2.	Extract the data from database using python
3.	Implement k-nearest neighbours classification using python
4.	Given the following data, which specify classifications for nine ombinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids)
5.	The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of 'golf' and the conditional probability of 'single' given 'medRisk' in the dataset
6.	Implement linear regression using python
7.	Implement naive baye's theorem to classify the English text
8.	Implement an algorithm to demonstrate the significance of genetic algorithm
9.	Implement the finite words classification system using Back-propagation algorithm
10	Additional Experiments: Find-S and Candidate Elimination Algorithms

Note: The above experiments are for indicative purposes only. However, the concerned faculty member can add a few more experiments in addition to the existing. In such cases the concerned faculty member should get the syllabus approved by the BoS.

R Programming Lab					M.Sc. 2nd year 1st semester			
Code	Category	Hours / Week			Credits	MARKS		
MS307	PC – LAB	L	T	P	C	Internal	End Exam	Total
		-	-	6	3	-	-	100

1. Download and install R-Programming environment and install basic packages using install. Packages () command in R.
2. Learn al the basics of R-Programming (Data types ,Variables , Operators etc.)
3. Implement R-Loops with different examples.
4. Learn the basics of functions in R and implement with examples.
5. Implement data frames in R. Write a program to join columns and rows in a data frame using c bind () and r bind () in R.
6. Implement different String Manipulation functions in R.
7. Implement different data structures in R(Vectors ,Lists ,Data Frames)
8. Write a program to read acsv file and analyze the data in the file in R
9. Create pie charts and bar charts using R.
10. Create a data set and do statistical analysis on the data using R.
11. Write R program to find Correlation and Covariance
12. Write R program for Regression Modeling
13. Write R program to build classification model using KNN algorithm
14. Write R program to build clustering model using K-mean algorithm

Note: The above experiments are for indicative purposes only. However, the concerned faculty member can add a few more experiments in addition to the existing. In such cases the concerned faculty member should get the syllabus approved by the BoS.

M.Sc. 2nd year 1st semester

MS308: MC: MOOCs Course: **Deep Learning**

Note: Students are evaluated based on the certification course they have Undergone during the semester. The courses need to be registered under the university recognized organizations and domains. This is mandatory course.

Note: All the MSc (Computer Science) students are mandatory for MOOC's Course. But MOOC's course has no syllabus.

M.Sc. II Year – IV Semester

S. No.	Course Code	Category	Course	Max Marks		Hours Per Week			Credits
				I	E	L	T	P	
1	MS401	PC	Data Mining	30	70	3	1	0	4
2	MS402A	PE-III	1. Cloud Computing	30	70	3	0	0	3
	MS402B		2. Computer Forensics						
	MS402C		3. Distributed Computing						
3	MS403A	PE-IV	1. Block Chain Technology	30	70	3	0	0	3
	MS403B		2. Neural Networks & Deep Learning						
	MS403C		3. Internet of Things (IoT)						
	MS403D		4. Research Methodology & Intellectual Property Rights (IPR)						
4	MS405	PROJ	Major Project	100	-	0	0	16	12
			TOTAL	**190**	**210**	**9**	**1**	**16**	**22**

Data Mining					M.Sc. 2nd year 2nd semester			
Code	Category	Hours / Week			Credits	MARKS		
MS401	PC	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Learning Objective (LO):

LO1	understand classical models and algorithms in data warehousing and data mining,
LO2	Enable students to analyse the data, identify the problems, and choose the relevant models and algorithms to apply
LO3	Assess the strengths and weaknesses of various methods and algorithms and to analyse their behavior.
LO4	Conceptualization and summarization of big data, big data computing technologies.
LO5	Demonstrate various challenges in processing Big Data.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Learn implementation of classical algorithms in data mining and data warehousing	K1
CO2	Learn to identify the application area of algorithms, and apply them	K1
CO3	Learn clustering application and resent works in data mining	K1
CO4	Understand the concepts of map and reduce and functional programming	K2
CO5	Interpret the characteristics of datasets and compare the trivial data and big data for various applications.	K1

UNIT – I

Data Warehouse: An Overview , What is Data Warehouse? Data warehouse Architecture - From Data Warehousing to Data Mining

OLAP Technology: A Multidimensional Data Model-Online Analytical Processing, OLAP Operations, ROLAP, HOLAP, MOLAP.

Learning Outcomes
Students upon completion of this unit will be able to

- Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

UNIT – II

Data mining – Introduction, Data mining on what kind of data, Data mining functionalities, classification of Data mining systems, Major issues in Data mining.

Mining Association rules in large databases - Association rule mining, Mining single-Dimensional Boolean association rules from Transactional databases, Mining multi-Dimensional Association rules from relational Databases and Data Warehouses.

Learning Outcomes
Students upon completion of this unit will be able to

- Understand the key issues in data management and its associated applications in intelligent business and scientific computing.
- Mining Association rules in Different types of Databases.

UNIT – III

Classification and Prediction - Introduction classification by decision tree induction, Bayesian Classification. Other classification methods, classification by back propagation, Prediction, classifier accuracy

Learning Outcomes
Students upon completion of this unit will be able to

- Decision trees
- Back propagation methods

UNIT – IV

Cluster analysis – Introduction types of data in cluster analysis a categorization of major clustering methods portioning methods, hierarchical methods, Density based methods, DBSCAN, Grid-based method STRING , Model based clustering method Statistical Approach, outlier analysis.

Learning Outcomes
Students upon completion of this unit will be able to

- Different Clustering Methods.
- Outlier Analysis.

UNIT – V

Big Data Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications.

Hadoop Hadoop Architecture, Hadoop Storage HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read., Hadoop MapReduce paradigm. Writing Hadoop MapReduce Programs

Learning Outcomes

Students upon completion of this unit will be able to

- understanding big data latest technology foundations.
- Acquire fundamental enabling techniques and scalable algorithms Hadoop, Map Reduce, HDFC architecture, HBase architecture in big data analytics.
- Interpret business models and scientific computing paradigms, and apply software tools for big data analytics

Prescribed TextBooks

1. Jiawei Han Micheline Kamber, “Data mining & Techniques”, Morgan Kaufmann publishers
2. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN 9788126551071, 2015.
3. Chris Eaton, Dirk deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.
4. Tom White, “HADOOP The definitive Guide” , O Reilly 2012.

Cloud Computing					M.Sc. 2nd year 2nd semester			
Code	Category	Hours / Week			Credits	MARKS		
MS402A	PE – III	L	T	P	C	Internal	End Exam	Total
		3	1	0	4	30	70	100

Learning Objective (LO):

LO1	The student will learn about the cloud environment, building software systems and components that scale to millions of users in modern internet
LO2	Cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas
LO3	Developing cloud based software applications on top of cloud platforms.
LO4	To provide students a sound foundation of the Cloud Application Architecture
LO5	To gain knowledge on various security issues in cloud architecture.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understanding the key dimensions of the challenge of Cloud Computing	K2
CO2	Assessment of the economics, financial, and technological implications for selecting cloud computing for own organization	K5
CO3	Obtain knowledge on cloud components, infrastructure and services	K3
CO4	Analyze various cloud application architectures.	K3
CO5	Apply various security measures on cloud architecture in solving real time security issues	K3

UNIT-I

Introduction Cloud computing at a glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies.

Principles of Parallel and Distributed Computing Eras of Computing, Parallel Vs Distributed computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for Distributed Computing.

Learning Outcomes
Students upon completion of this unit will be able to

- Understand historical developments of Cloud Environments
- Understand the concepts of Parallel and Distributed Computing.

UNIT-II

Virtualization Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples.

Cloud Computing Architecture Introduction, Cloud reference model, Types of clouds, Economics of the cloud, open challenges.

Learning Outcomes
Students upon completion of this unit will be able to

- identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- Describe importance of virtualization along with their technologies

UNIT-III

Aneka Cloud Application Platform Framework Overview, Anatomy of the Aneka Container, Building Aneka Clouds, Cloud programming and Management.

Concurrent Computing Thread Programming Introducing Parallelism for Single machine Computation, Programming Application with Threads, Multithreading with Aneka, Programming Applications with Aneka Threads.

Learning Outcomes
Students upon completion of this unit will be able to

- Understand the Aneka Cloud Application Platform
- Understand concurrent programming in cloud computing.

UNIT-IV

High- Throughput Computing Task Programming Task Computing, Task-based Application Models, Aneka Task-Based Programming.

Data Intensive Computing Map-Reduce Programming What is Data-Intensive Computing, Technologies for Data-Intensive Computing, Aneka MapReduce Programming.

Learning Outcomes
Students upon completion of this unit will be able to

- Understanding the high throughput Computing
- Understanding data intensive computing

UNIT-V

Cloud Platforms in Industry Amazon Web Services, Google AppEngine, Microsoft Azure, Observations.

Cloud Applications Scientific Applications, Business and Consumer Applications.

Advanced Topics in Cloud Computing Energy Efficiency in Clouds, Market Based Management of Clouds , Federated Clouds/ InterCloud, Third Party Cloud Services.

Learning Outcomes

Students upon completion of this unit will be able to

- Understand different Cloud Applications
- Understanding the key dimensions of the challenge of Cloud Computing

Prescribed Book

- Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, "Mastering Cloud Computing", Mc Graw Hill Education.

REFERENCES

1. Michael Miller, “Cloud Computing”, Pearson Education, New
2. Haley Beard, Cloud Computing Best Practices for Managing and MeasuringProcesses for On-demand Computing, Applications and Data Centers in theCloud with SLAs, Emereo Pty Limited, July 2008.
3. Cloud Application Architectures, George Reese, ISBN 8184047142,Shroff/O' Reilly, 2009.

Computer Forensics					M.Sc. 2nd year 2nd semester			
Code	Category	Hours / Week			Credits	MARKS		
MS402B	PE – III	L	T	P	C	Internal	End Exam	Total
		3	0	0	3	30	70	100

Course Objectives

1. Explain the responsibilities and liabilities of a computer forensic investigator
2. Plan and prepare for an incident requiring computer forensic skills
3. Seize a computer from a crime scene without damaging it or risking it becoming inadmissible in a court of law
4. Explain where digital evidence resides on computer storage devices
5. Hire experts to perform detailed forensic analysis and expert testimony

Course Outcomes

1. understand the role of computer forensics in the business and private world
2. identify some of the current techniques and tools for forensic examinations
3. describe and identify basic principles of good professional practice for a forensic computing practitioner
4. Apply forensic tools in different situations.

Unit I

Introduction to Computer Forensics *:* Computer forensics definitions ,Computers' roles in crimes ,Computer forensics tasks ,Prepare for an investigation, Collect evidence ,Preserve evidence ,Recover evidence, Document evidence Challenges associated with making "cybercrime" laws, Jurisdictional issues.

Unit II

Computer Crimes :Crimes ,Violent crimes where computers are used include terrorism, assault threat, stalking, child pornography ,Nonviolent crimes where computers are used include trespass, theft, fraud, vandalism , Where evidence often resides for different types of crimes ,Address books, chat logs, e-mail, images, movies, Internet browser history, etc.

Unit III

Computer Criminals: Using evidence to create a crime timeline , Modify Access Create (MAC) dates associated with files ,Problems with using these (they don't change in a logical fashion in some cases) ,Criminals and crime fighters ,Understanding "cyber criminals" and their victims ,Understanding "cyber investigators.

Unit IV

Building a Cybercrime Case*:* Bodies of law ,Constitutional law ,Criminal law ,Civil law ,Administrative regulations ,Levels of law ,Local laws ,State laws ,Federal laws ,International laws ,Levels of culpability ,Intent ,Knowledge ,Recklessness ,Negligence , Level and burden of proof ,Criminal versus civil cases ,Vicarious liability ,Laws related to computers ,CFAA, DMCA, CAN Spam, etc.

Unit V

Preserving and Recovering Digital Evidence*:* Disk imaging ,Creating a message digest or hash code for a disk ,Where data hides; deleted and erased data ,File systems ,Files ,Modify Access Create (MAC) dates to establish time line ,File headers - info about file type

References books

1. Guide to Computer Forensics and Investigations ,By Bill Nelson, Amelia Phillips, christopher Steuart
2. Scene of the Cybercrime, by Debra Littlejohn Shinder.
3. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles River Media, 2005
4. Christof Paar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners, 2nd Edition, Springer's, 2010
5. Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Ali Jahangiri, 2009
6. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series: Computer Forensics), 2010

Student Activity:

1. Collect calls made from a cell tower and analyze them
2. Trace the IP address of the machine from which you received a email

Distributed Computing					M.Sc. 2nd year 2nd semester			
Code	Category	Hours / Week			Credits	MARKS		
MS402C	PE – III	L	T	P	C	Internal	End Exam	Total
		3	0	0	3	30	70	100

COURSE OBJECTIVES:

- To introduce the computation and communication models of distributed systems
- To illustrate the issues of synchronization and collection of information in distributed systems
- To describe distributed mutual exclusion and distributed deadlock detection techniques
- To elucidate agreement protocols and fault tolerance mechanisms in distributed systems
- To explain the cloud computing models and the underlying concepts

UNIT I

Introduction: Definition-Relation to Computer System Components – Motivation – Message - Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.

UNIT II

Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order
– Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.

UNIT III

Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – RicartAgrawala's Algorithm — Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.

UNIT IV

Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm - - Algorithm for Asynchronous Checkpointing and Recovery

UNIT V

Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services

COURSE OUTCOMES:

Upon the completion of this course, the student will be able to

CO1: Explain the foundations of distributed systems (K2)

CO2: Solve synchronization and state consistency problems (K3)

CO3 Use resource sharing techniques in distributed systems (K3)

CO4: Apply working model of consensus and reliability of distributed systems (K3)

CO5: Explain the fundamentals of cloud computing (K2)

TEXT BOOKS

- Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", Cambridge Press, 2011.
- Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating systems", McGraw Hill Publishers, 1994.

REFERENCES

- George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
- Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
- Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
- Liu M L, "Distributed Computing: Principles and Applications", Pearson Education, 2004.
- Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, 2003.
- Arshdeep Bagga, Vijay Madisetti, " Cloud Computing: A Hands-On Approach", Universities Press, 2014.

BLOCK CHAIN TECHNOLOGY					M.Sc. 2nd year 2nd semester			
Code	Category	Hours / Week			Credits	MARKS		
		L	T	P	C	Internal	End Exam	Total
MS403A	PE – IV	3	0	0	3	30	70	100

Learning Objective (LO):

LO1	To introduce the concept of Blockchain
LO2	To overcome the problems of centralization
LO3	To introduce the concept of Bitcoin
LO4	To make them familiar with Bitcoin network, payments, clients and APIs.
LO5	To make them familiar with payments with Bitcoin network

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Know the basics of Blockchain Terminology.	
CO2	Understand the concept of Blockchain, Bitcoin	
CO3	Understand de-centralization	
CO4	Gain knowledge about the domain of blockchain in real time.	
CO5	How to do payments with Bitcoin network.	

UNIT – I

Blockchain , the growth of blockchain technology, distributed systems, the history of blockchain and Bitcoin, types of blockchain

Learning Outcomes

Students upon completion of this unit will be able to

- Understand the structure of a blockchain and why/when it is better than a simple distributed database

UNIT –II

Decentralization , methods of decentralization , routes of decentralization, blockchain and full ecosystem decentralization, smart contracts, Decentralized organizations and platforms for decentralization.

Learning Outcomes

- Analyze the incentive structure in a blockchain based system and critically assess its functions, benefits and vulnerabilities;

UNIT – III

Symmetric Cryptography , working with the OpenSSL command line, cryptographic primitives. Public Key Cryptography, asymmetric cryptography, public and private keys and financial markets and trading.

Learning Outcomes

Students upon completion of this unit will be able to

- Work with openSSL command line environment
- Apply cryptography systems

UNIT – IV

Introducing Bitcoin, Bitcoin, digital keys and addresses, transactions, blockchain, mining. Alternative Coins. Limitations of Bitcoin

Learning Outcomes

Students upon completion of this unit will be able to

- Understand how blockchain system Bitcoin works

UNIT – V

Bitcoin Network and payments, The Bitcoin network, wallets, Bitcoin payments, innovation in Bitcoin, Bitcoin Clients and APIs.

Learning Outcomes

Students upon completion of this unit will be able to

- Perform payment operations with Bitcoin Network

Prescribe Book

- Mastering Blockchain 2nd Edition, Imran Bashir, PACKT Publication

Reference Books

- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies a comprehensive introduction. Princeton University Press, 2016.

Neural Networks & Deep Learning					M.Sc. 2nd year 2nd semester			
Code	Category	Hours / Week			Credits	MARKS		
MS403B	PE – IV	L	T	P	C	Internal	End Exam	Total
		3	0	0	3	30	70	100

COURSE OBJECTIVES:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train
- deep neural networks for various tasks. To apply autoencoders and generative models for suitable applications.

UNIT I

INTRODUCTION: Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An IntroductionEvolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

UNIT II

ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS: Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization- Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III

THIRD-GENERATION NEURAL NETWORKS: Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression.

UNIT IV

DEEP FEEDFORWARD NETWORKS: History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization-VC Dimension and Neural Nets.

UNIT V

RECURRENT NEURAL NETWORKS: Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Apply Convolution Neural Network for image processing.

CO2: Understand the basics of associative memory and unsupervised learning networks.

CO3: Apply CNN and its variants for suitable applications.

CO4: Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.

CO5: Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:

- Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
- Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

REFERENCES:

- Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.
- Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
- Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
- Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
- Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
- Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017. 7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.
- Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
- James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

Internet Of Things					M.Sc. 2nd year 2nd semester			
Code	Category	Hours / Week			Credits	MARKS		
MS403C	PE – IV	L	T	P	C	Internal	End Exam	Total
		3	0	0	3	30	70	100

Objectives

The course is designed to meet the objectives of

- To introduce the concept of IoT
- To introduce the concept of M2M
- To understand the logical design
- To make them familiar with IoT devices, endpoints and designing

UNIT – I

Introduction to Internet of Things, Introduction, physical design, logical design, IoT enabled technologies, IoT levels & deployment templates. Domain specific IoTs, Introduction, home automation, cities, environment, energy, retial, logistics, agriculture,Industry and health & lifestyle.

Learning Outcomes

Students upon completion of this unit will be able to

- Familiarized with IoT Terminology
- Understand the concept of IoT

UNIT – II

IoT and M2M, Introduction, M2M, difference between IoT and M2M, SDN and NFV for IoT, IoT system management with NETCONF-YANG, need for IoT systems management, SNMP, network operator requirements, ETCONF,YANG.

Learning Outcomes

Students upon completion of this unit will be able to

- Realize the revolution of Internet in Mobile Devices
- Undestnad Iot System Management with NETCONF-YANG

UNIT – III

IoT platforms design methodology, Introduction, IoT design methodology, case study,motivation for using Python. IoT Systems – Logical design using python, introduction, python data types and structures, control flow, functions, modules, packages, file handling, date/time operations, classes and packages.

Learning Outcomes

Students upon completion of this unit will be able to

- Understand various stages of IOT architecture
- Basic knowledge on Python programming.

UNIT – IV

IoT physical Devices and endpoints, IoT devices, Raspberry Pi, Raspberry Pi interfaces, programming Raspberry Pi with Python. Case Studies Illustrating IoT Design, home automation, cities, environment and agriculture&productivity applications.

Learning Outcomes

Students upon completion of this unit will be able to

- Understand Raspberry Pi interfaces.
- Evaluate case studies on IOT design

UNIT V

APPLICATIONS DEVELOPMENT: Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

Prescribe Book

- Internet of Things – A Hands-On Approach, Arsdeep Bahga & Vijay Madisetti,
- Universities Press

Reference Books

- The Internet of Things Enabling Technologies, Platforms, and Use Cases, Pethuru Raj
- and Anupama C. Raman, CRC Press.
- Iot Fundamentals Networking Technologies, Protocols and Use Cases for the Internet
- of Things , David, Hanes & Salgueiro Gonzalo, Pearson

Research Methodology & Intellectual Property Rights (IPR)		M.Sc. 2nd year 2nd semester						
Code	Category	Hours / Week			Credits	MARKS		
		L	T	P	C	Internal	End Exam	Total
MS403D	PE – IV	3	0	0	3	30	70	100

Course Description and Purpose:

The aim of this course is to develop research bent of mind (spirit of inquiry) and impart research skills to all Post graduate students. It also encompasses the series of research methodology contents: from problem formulation, to design, to data collection, analysis, reporting and dissemination. This course also covers intellectual property rights (IPR), and intended to equip students with conceptual understanding of current scenario of IPR, and the practical issues encountered in filing patents, trademarks and copyrights.

Course Objectives:

- To understand some basic concepts of research and its methodologies
- To develop an understanding of the basic framework of research processes.
- To develop an understanding of various research designs and techniques.
- To identify various sources of information for literature review and data collection.
- Ability to write a research Proposal, report and thesis
- To demonstrate knowledge and understanding of IPR Filing and Rights

Course Learning Outcomes:

Upon successful completion of the course, the student will be able to:

- CO-1: Understand some basic concepts of research and its methodologies
- CO-2: Identify appropriate research topics
- CO-3: Select and define appropriate research problems and parameters
- CO-4: Demonstrate the ability to choose methods appropriate to research aims and objectives
- CO-5: Have adequate knowledge on measurement & scaling techniques
- CO-6: Have basic awareness of data analysis-and hypothesis testing procedures

Course Content:

UNIT I

Foundations of Research

Meaning of Research – Definitions of Research – Motivation in Research – General Characteristics of Research– Criteria of Good Research – Types of Research – Research Process – Research Methods vs. Methodology – Defining and Formulating the Research Problem – Review of Literature – Approaches to Critical Literature Review – Importance of Literature Review in Identifying Research Gaps and Defining a Problem – Development of Working Hypothesis.

UNIT II

Research Design, Sampling Concepts, and Data Collection Methods
Meaning, Significance and Characteristics of Good Research Design – Types of Research Design: Exploratory, Conclusive Research and Experimental – Sampling Theory: Types of Sampling and Errors in Sampling – Data Collection: Types of Data – Data Collection Methods and Techniques for Primary and Secondary Data.

UNIT III

Measurement & Scaling Techniques, Hypothesis Formulation and Testing, Overview of Data Analysis and Report Writing
Basic measurement scales – Reliability & Validity – Definition and Types of Hypothesis – Hypothesis Formulation and Testing Procedure – Overview of Data Analysis: Methods, Process and Types – Report Writing: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports – How to Write a Research Proposal, Research Ethics, Conflict of Interest and Plagiarism.

UNIT IV

Intellectual Property Rights (IPR)
Definition and Nature and Features of Intellectual Property Rights (IPR) – Types of Intellectual Property Rights – Procedure for Grants of Patents – Rights of a Patent – Scope of a Patent Rights
–Licensing and Transfer of Technology – Why protection of intellectual property is important?
–Enforcement of IPR – Infringement of IPR.

UNIT V

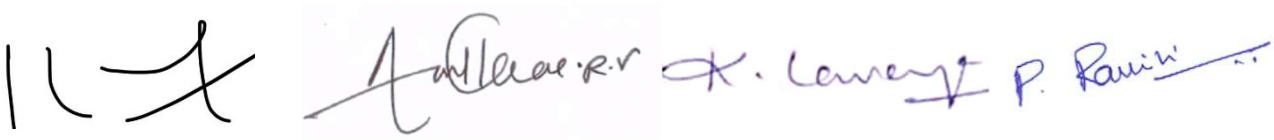
Indian and International Scenario and New Developments in IPR
IPR Developments in India for the past Five Years – Development of IPR Laws in India – International Cooperation on IPR – New Developments in IPR – Administration of Patent System – International Patent protection – Case Studies in Indian and Global Contexts.

Textbooks:

- Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002, An introduction to Research Methodology, RBSA Publishers.
- Cohen, L. Lawrence, M., & Morrison, K. (2005), Research Methods in Education (5thedition). Oxford: Oxford University Press.
- Kothari, C.R., 1990, Research Methodology: Methods and Techniques, New Age International.
- Dornyei, Z. (2007). Research Methods in Applied Linguistics. Oxford: Oxford University Press.
- Anthony, M., Graziano, A.M. and Raulin, M.L., 2009, Research Methods: A Process of Inquiry, Allyn and Bacon.

PROJECT					M.Sc. 2nd year 2nd semester			
Code	Category	Hours / Week			Credits	MARKS		
MS404	PC	L	T	P	C	Internal	End Exam	Total
		0	0	4	12	-	-	100

The department concerned should guide students in selecting contemporary project topics and provide supervision throughout the project, emphasizing current technologies, research orientation, implementation, and professional documentation.



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