VIVEKANANDA GLOBAL UNIVERSITY, JAIPUR
(Established under Rajasthan Act 17 of 2012 and Section 2(f) Covered under Section 2(f) of UGC Act, 1956)
Recognised by UGC, Council of Architecture (COA), Bar Council of India (BCI), Pharmacy Council of India (PCI) and All India Council for Technical Education (AICTE) for conducting Courses
VGU/2020-21/ 3938 Date: 30/01/2021

Minutes of the Joint Meeting of BOF and BOS

Draft Minutes of the 3rd Joint Meeting of Board of Studies and Board of Faculty, Faculty of Computer Application, held the Meeting at 11:00 am on 30th Jan, 2021 in Computer Department and through the online platform.

Following members were present:

1. Dr. Anil Choudhary, Professor, NSIT – External Member
2. Mr. Sunil Kumar , Academic Manager, NextGen Courses - CTPL External Member
3. Mr. Sitaram Gupta, HOD, CS
4. Mr. Dushyant Sigh, Faculty , Internal Member
5. Ms. Megha Sharma, Faculty , Internal Member
6. Sandeep Jain, Inter Disciplinary Member, VGU

Leave of absence was granted to:

1. Mr. Ripu Daman, Director, Natural Group and Conserve InfoTech. Private Ltd- External Member
2. Prof. R. P. Kashyap, Professor, VGU, Internal Member

Convener welcomed the members of the meeting as thereafter Member discussed the scheme and syllabus of BCA(CTPL) and BCA(VGU) Program of Computer Science.

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Following decisions were taken.

1. After Reviewing the paper setter panel of BCA(CTIS) program for Session 2020-21, Even Semester, BOS approved without changes.
2. After Reviewing the paper setter panel of BCA(AI) program for Session 2020-21, Even Semester, BOS approved without changes.
3. Reviewed and discussed the scheme and syllabus of BCA(CTIS) program and recommended that no changes are required in the current approved scheme and syllabus for session 2020-21.
4. Reviewed and discussed the scheme and syllabus of BCA(AI) program and recommended that no changes are required in the current approved scheme and syllabus for session 2020-21.
5. Any other item with the permission of the Chair.

a. BOS and BOF members Discussed about the Cloud Computing technology and told that during the COVID- Pandemic Situation, cloud computing technology play the important role to control it. After that, Members Suggested more subject of Cloud Computing paper need to be incorporate in the scheme and syllabus of the BCA program.

Thereafter the Meeting Ended with a Vote of Thanks to the Chair.

Prof (Dr.) Baldev Singh
Convener, BOF

Copy for All BOS and BOF Members' Professor

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VGU/2020-21/3900

Date: 23/01/2021

Notice

To all members "Board of Faculty and Board of Studies"

The 3rd joint meeting of the **Board of Studies**(BOS) and **Board of Faculty** (BOF) of the **Faculty of Computer Application** will be held at 11:00 am on 30th, Jan, 2021 in VIT-east Board Room. Following are the Agenda points of Meeting.

Item No.3.1 - To review the teaching scheme and syllabi of BCA Program
Item No.3.2 - Approval of the Paper setter panel for upcoming Semester
Item No.3.3- Any other item with the permission of the Chair.

You are requested to kindly make it convenient to attend the said meeting of the BOS and BOF. Meeting May be Attended through Video Conferencing. The mode of participation May please be confirmed the under signed.

In the absence of your confirmation it shell be presumed that you will be attending BOS Meeting in person and not through the video conference.

Kind Regards

Prof. (Dr.) Baldev Singh
Dean & Convener BOF

Copy to:-

1. Mr. Ripu Daman, Director, Natural Group and Conserve InfoTech, Private Ltd- External Member
2. Dr. Anil Choudhary, Professor, SKIT, - External Member
3. Mr. Sunil Kumar , Academic Manager, NextGen Courses - CTPL External Member
4. Prof. R. P. Kashyap, Professor , VGU, Internal Member
5. Mr. Sitaram Gupta, HOD, CS
6. Mr. Dushyant Sigh, Faculty, Internal Member
7. Ms. Megha Sharma, Faculty, Internal Member
8. Sandeep Jain, Inter Disciplinary, Member, VGU

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Date: 30/01/2021

BOF and BOS - Department of Computer Science

Attendance Sheet 30, Jan, 2021

S.No	Name	Signature
1	Prof (Dr.) Baldev Singh, Dean Engg. Convener, BOF	
2	Mr. Ripu Daman, Director, Natural Group and Conserve InfoTech, Private Ltd- External Member	
3	Prof. R. P. Kashyap, Professor , VGU, Internal Member	
4	Dr. Anil Choudhary, Professor, SKIT, - External Member	attend on line
5	Mr. Sunil Kumar , Academic Manager, NextGen Courses - CTPL External Member	
6	Mr. Sitaram Gupta, HOD, CS	
7	Mr. Dushyant Sigh, Faculty, Internal Member	
8	Ms. Megha Sharma, Faculty, Internal Member	
9	Sandeep Jain, Inter Disciplinary, Member, VGU	

Prof (Dr.) Baldev Singh,
Dean Engg. Convener, BOF

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VIVEKANANDA GLOBAL UNIVERSITY

(Established by Rajasthan State Legislature and covered u/s 2(f) of the UGC Act, 1956)

FACULTY OF COMPUTER SCIENCE & APPLICATION

Scheme & Syllabus

for

Master of Computer Application

(Implemented from Academic Session 2021-22)

Total Credit of the Program

Sem	I	II	III	IV	Total
Credits	26	26	26	16	94

Vivekananda Global University Academic Council Jaipur

Session 2021-22

Sector-36, NRI Road, Jagatpura, Jaipur (Raj.)-303012
Ph.: 0141-2851000 Fax: 2851000; Email: info@vgu.ac.in Website: www.vgu.ac.in

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VIVEKANANDA
GLOBAL UNIVERSITY
(Established by Rajasthan State Legislature and covered u/s 2(f) of the UGC Act, 1956)

Approved Scheme and Syllabus of programme

Master of Computer Application

Under Faculty of

FACULTY OF COMPUTER SCIENCE & APPLICATION

For session

2021-22

.....
Convener BOS/HoD

.....
Convener BOF/Dean Faculty

.....
President (VGU)

Vivekananda Global University Academic Council Jaipur

Sector-36, NRI Road, Jagatpura, Jaipur (Raj.)-303012
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PROGRAM OUTCOMES

1. **Computational Knowledge:** Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
2. **Problem analysis**: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences and relevant domain disciplines.
3. **Design/development of solutions**: Design solutions for complex Computer Science & Application problems and design system components or processes.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern science and IT tools necessary for modeling complex computer science domain activities.
6. **Professional Ethics**: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.
7. **Lifelong learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
8. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
9. **Communication**: Communicate effectively on complex computer science activities with the science & application community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
10. **Environment and sustainability**: Understand the impact of the professional science and application solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
11. **Individual and team work**: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
12. **Innovation and Entrepreneurship:** Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.

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PROGRAM SPECIFIC OUTCOMES

PSO1: Explore technical comprehension in varied areas of Computer Applications at Post Graduate Level and experience a conducive environment in cultivating skills for thriving career and higher studies.

PSO2: Comprehend, explore and build up computer programs in the allied areas like Algorithms, System Software, Cyber Security, Artificial Intelligence, Web Design and Data Analytics for efficient design of computer-based systems of varying complexity.

PSO 3: The ability to employ modern computer languages, environments, and platforms to build Project Development Skills & innovative career paths by understanding the structure and development methodologies of software systems

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Evaluation Scheme

Evaluation Component	Weightage to be given	Exam Duration
Theory Paper		
Mid Term 1	10 %	1.5 Hrs
Mid Term 2	10 %	1.5 Hrs
Session Components A1, A2, A3, A4, A5, Q1, Q2,Q3 (Average from each unit 1-5 out of 5% of each as Quiz Assignment, Seminars, Presentations, Attendance, Case study, Surprise class test, Lab record, Viva, Projects, and Observation	8 x 2.5 % = 20 %	
End Term Exam	**60 %**	**3 Hrs**
Practical Paper		
Mid Term 1	15 %	1.5 Hrs
Mid Term 2	15 %	1.5 Hrs
Assignments, Projects, and other 8 components	8x 3.75 % = 30	-
End Term Practical Exam	**40%**	**3 Hrs**

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TEACHING AND EXAMINATION SCHEME FOR

Master of Computer Application

(Common for Specialization CTIS and AI)

SEMESTER I

Course Code	Course Type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCA 101	PCC	Mathematical Foundation for Computer Application	3	1	-	4	4
MCA 102	PCC	Basic Programming	3	1	-	4	4
MCA 103	PCC	Data Structures and Algorithms	3	-	-	3	3
MCA 104	PCC	Object Oriented Programming using C++	3	-	-	3	3
MCA 105	PCC	Software Engineering	3	-	-	3	3
MCA 106	PCC	Introduction to Cloud Technology	3	-	-	3	3
MCA 107	PCC	Basic Programming Lab	-	-	4	4	2
MCA 108	PCC	Object Oriented Programming using C++ Lab	-	-	4	4	2
MCA 109	PCC	Software Engineering Lab	-	-	4	4	2
TOTAL			**18**	**2**	**12**	**32**	**26**

L*-Lecture*, T*-Tutorial, P*-Practical

Vivekananda Global University, Jaipur

APPROVED

TEACHING AND EXAMINATION SCHEME FOR

Master of Computer Application

(Specialization in Cloud Technology and Information Security)

SEMESTER II

Course code	Course Type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCA 201	PCC	Java Programming	3	1	-	4	4
MCA 202	PCC	Design and Analysis of Algorithms	3	1	-	4	4
MCA 203	PCC	Database Management System	3	-	-	3	3
MCA 204	PCC	Computer Networks	3	-	-	3	3
MCA*	PEC	Program Elective I	3	-	-	3	3
MCA*	PEC	Program Elective II	3	-	-	3	3
MCA 205	PCC	Java Programming Lab	-	-	4	4	2
MCA 206	PCC	Design and Analysis of Algorithms Lab	-	-	4	4	2
MCA 207	PCC	Database Management System Lab	-	-	4	4	2
TOTAL			**18**	**2**	**12**	**32**	**26**

CTIS - Cloud Technology & Information Security

L*-Lecture*, T*-Tutorial, P*-Practical

Course Code	Program Elective I
MCACT 201	Cloud Architectural Patterns
MCACT 202	Cryptography
MCACT 203	PowerShell Scripting
MCACT 204	Ethical Hacking

Course Code	Program Elective II
MCACT 205	Information & Network Security
MCACT 206	Computer Graphics and Visualization
MCACT 207	Distributed Operating Systems
MCACT 208	Advance Computer Networks

TEACHING AND EXAMINATION SCHEME FOR

Master of Computer Application

(Specialization in Cloud Technology and Information Security)
SEMESTER-III

Course Code	Course Type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCACT 301	PCC	Storage and Data Center	3	1	-	4	4
MCACT 302	PCC	Cloud Security	3	-	-	3	3
MCA*	PEC	Program Elective III	3	-	-	3	3
MCA*	PEC	Program Elective IV	3	-	-	3	3
MCA*	PEC	Program Elective V	3	-	-	3	3
MCACT 303	PCC	Storage and Data Center Lab	-	-	4	4	2
MCACT 304	PCC	Cloud Security Lab	-	-	4	4	2
MCA 301	PSIT	Seminar	-	-	4	4	2
MCA 302	PSIT	Project Phase - I	-	-	-	8	4
		Total	**15**	**1**	**12**	**36**	**26**

Course Code	Program Elective III
MCACT 305	Principles of Virtualization
MCACT 306	Cloud Migration
MCACT 307	Linux Administration
MCACT 308	Security Architecture

Course Code	Program Elective IV
MCACT 309	Database Security
MCACT 310	Server Security
MCACT 311	IOT Security
MCACT 312	Web Security

Course Code	Program Elective V
MCACT 313	IT Governance & Risk Management
MCACT 314	Cyber Forensics
MCACT 315	Cyber Crime & IT Law
MCACT 316	Bio Informatics

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TEACHING AND EXAMINATION SCHEME FOR

Master of Computer Application

(Specialization in Cloud Technology and Information Security)

SEMESTER-IV

Course code	Course type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCA 401	PSIT	Project Phase – II/Industry Internship	-	-	-	16	16
		Total	-	-	-	**16**	**16**

L*-Lecture*, T*-Tutorial, P*-Practical

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TEACHING AND EXAMINATION SCHEME FOR

Master of Computer Application

(Specialization in Artificial Intelligence)

SEMESTER II

Course code	Course Type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCA 201	PCC	Java Programming	3	1	-	4	4
MCA 202	PCC	Design and Analysis of Algorithms	3	1	-	4	4
MCA 203	PCC	Database Management System	3	-	-	3	3
MCA 204	PCC	Computer Networks	3	-	-	3	3
MCA*	PEC	Program Elective I	3	-	-	3	3
MCA*	PEC	Program Elective II	3	-	-	3	3
MCA 205	PCC	Java Programming Lab	-	-	4	4	2
MCA 206	PCC	Design and Analysis of Algorithms Lab	-	-	4	4	2
MCA 207	PCC	Database Management System Lab	-	-	4	4	2
TOTAL			**18**	**2**	**12**	**32**	**26**

L*-Lecture*, T*-Tutorial, P*-Practical

Course Code	Program Elective I
MCAAI 201	Introduction to Data Science
MCAAI 202	Internet of Things
MCAAI 203	Machine Learning
MCAAI 204	Natural Language Processing

Course Code	Program Elective II
MCAAI 205	Data Mining & Warehousing
MCAAI 206	Robotic Operating Systems
MCAAI 207	Knowledge Engineering & Expert Systems
MCAAI 208	Computer Vision

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TEACHING AND EXAMINATION SCHEME FOR

Master of Computer Application

(Specialization in Artificial Intelligence)

SEMESTER-III

Course Code	Course Type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCAAI 301	PCC	Deep Learning	3	1	-	4	4
MCAAI 302	PCC	Reinforcement Learning	3	-	-	3	3
MCA*	PEC	Program Elective III	3	-	-	3	3
MCA*	PEC	Program Elective IV	3	-	-	3	3
MCA*	PEC	Program Elective V	3	-	-	3	3
MCAAI 303	PCC	Deep Learning Lab	-	-	4	4	2
MCAAI 304	PCC	Reinforcement Learning Lab	-	-	4	4	2
MCA 301	PSIT	Seminar	-	-	4	4	2
MCA 302	PSIT	Project Phase – I	-	-	-	8	4
		Total	**15**	**1**	**12**	**36**	**26**

Course Code	Program Elective III
MCAAI 305	Pattern Recognition
MCAAI 306	Speech & Biometric Processing
MCAAI 307	Blockchain
MCAAI 308	Management Information System

Course Code	Program Elective IV
MCAAI 309	Prolog Programming
MCAAI 310	Embedded System
MCAAI 311	Artificial Intelligence & Intelligent Agents
MCAAI 312	Distributed Operating Systems

Course Code	Program Elective V
MCAAI 313	Big Data Analytics
MCAAI 314	Semantic Web
MCAAI 315	Business Intelligence
MCAAI 316	Bio Informatics

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TEACHING AND EXAMINATION SCHEME FOR

Master of Computer Application

(Specialization in Artificial Intelligence)

SEMESTER-IV

Course code	Course type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCA 401	PSIT	Project Phase – II/Industry Internship	-	-	-	16	16
		Total	-	-	-	**16**	**16**

AI - Artificial Intelligence

L*-Lecture*, T*-Tutorial, P*-Practical

Vivekananda Global University Academic Council Jaipur

TEACHING AND EXAMINATION SCHEME FOR MCA

(Common for Specialization CTIS and AI)

SEMESTER I

Course Code	Course Type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCA 101	PCC	Mathematical Foundation for Computer Application	3	1	-	4	4
MCA 102	PCC	Basic Programming	3	1	-	4	4
MCA 103	PCC	Data Structures and Algorithms	3	-	-	3	3
MCA 104	PCC	Object Oriented Programming using C++	3	-	-	3	3
MCA 105	PCC	Software Engineering	3	-	-	3	3
MCA 106	PCC	Introduction to Cloud Technology	3	-	-	3	3
MCA 107	PCC	Basic Programming Lab	-	-	4	4	2
MCA 108	PCC	Object Oriented Programming using C++ Lab	-	-	4	4	2
MCA 109	PCC	Software Engineering Lab	-	-	4	4	2
TOTAL			**18**	**2**	**12**	**32**	**26**

L*-Lecture*, T*-Tutorial, P*-Practical

 APPROVED

Semester I **MCA (CTIS)**

MCA 101: MATHEMATICAL FOUNDATION FOR COMPUTER APPLICATION

3L + 1T + 0P + 4 C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Ability to apply mathematical logic to solve problems.

COURSE OUTCOME: The student would be able:

CO 1. Evaluate the validity of logical arguments and construct mathematical proofs.
CO 2. Analyze whether given graphs are isomorphic and apply different algorithms to find the shortest path.
CO 3. Apply the concept of two-dimensional random variables to correlation, regression and Central limit theorem.
CO 4. Learn and apply multivariate analysis necessary for Principal Component Analysis.
CO 5. Identify the Markovian queueing model in the given system, find the performance measures and analyze the results.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Logic	7
2	Combinatorics	7
3	Algebraic Structures	6
4	Recursive Functions	6
5	Lattices	6

Detailed Syllabus

Unit 1: Statements – Connectives – Truth Tables – Normal forms – Predicate calculus – Inference – Theory for Statement Calculus and Predicate Calculus – automata theorem proving.

Unit 2: Review of Permutation and Combination - Mathematical Induction - Pigeon hole principle - Principle of Inclusion and Exclusion - generating function - Recurrence relations.

Unit 3: Semigroup - Monoid – Groups (Definition and Examples only) Cyclic group - Permutation group(Sn and Dn) - Substructures - Homomorphism of semigroup, monoid and groups - Cosets and Lagrange Theorem – Normal Subgroups - Rings and Fields (Definition and examples only)

Unit 4: Recursive functions - Primitive recursive functions - computable and non - computable functions.

Unit 5: Partial order relation, poset - Lattices, Hasse diagram - Boolean algebra

Text/Reference Books

1. Gersting J.L., Mathematical Structure for Computer Science, 3rd Edition W.H. Freeman and Co., 1993.
2. Lidl and pitz., Applied Abstract Algebra, Springer - Verlag, New York, 1984.
3. K.H. Rosen, Discrete Mathematics and its Applications, Mc-Graw Hill Book Company, 1999.
4. http://www.mhhe.com//rosen.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	–	–	–	–	–	3	3	1	3	2	2	2
CO2	–	–	–	–	–	2	3	1	3	1	1	–
CO3	–	–	–	–	–	–	–	–	3	–	–	–
CO4	–	–	–	3	–	–	–	–	–	–	–	–
CO5	2	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

Semester I **MCA (CTIS)**

MCA 102: BASIC PROGRAMMING

3L + 1T + 0P + 4C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To setup the environment to run the python programs
- To understand concepts about Data Types and Looping techniques
- To understand and implement the different concepts, Decorators, and Iterators
- To understand and build the Web Applications
- Debugging and Troubleshooting Python Programs.

COURSE OUTCOME: After completion of this course students should be able to: -

CO 1. Write, Test and Debug Python Programs
CO 2. Use Conditionals and Loops for Python Programs
CO 3. Use functions and represent Compound data using Lists, Tuples and Dictionaries
CO 4. Use various applications using python
CO 5. Develop the ability to write database applications in Python

OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the
1.	Introduction & Overview	10
2.	Python Objects	8
3.	Numbers and Strings	8
4.	Lists	8
5.	Files and Input/Output	8

Detailed Syllabus

Unit 1: INTRODUCTION & OVERVIEW: - Introduction, What is Python, Origin, Comparison, Comments, Operators, Variables and Assignment, Numbers, Strings, Lists and Tuples, Dictionaries, if Statement, while Loop, for Loop and the range, Built-in Function, Files and the open() Built-in Function, Errors and Exceptions, Functions, Classes, Modules.
Syntax & styles: Statements and Syntax, Variable Assignment, Identifiers, Basic Style Guidelines, Memory Management, Python Application Examples.

Unit 2: PYTHON OBJECTS: - Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types.

Unit 3: NUMBERS AND STRINGS: - Introduction to Numbers, Integers, Floating Point Real numbers, Complex Numbers, Operators, Built-in Functions. Sequences: Strings, Lists, and Tuples,

Sequences, Strings, Strings and Operators, String-only Operators, Built-in Functions, String Built-in Methods, Special Features of Strings.

Unit 4: LISTS: - Operators, Built-in Functions, List Type Built-in Methods, Special Features of Lists, Tuples, Tuple Operators and Built-in Functions, Special Features of Tuples.
Conditionals and Loops: -if statement, else Statement, else if Statement, while Statement, for Statement, break Statement, continue Statement, pass Statement, else Statement.

Unit 5: FILES AND INPUT/OUTPUT: - File Objects, File Built-in Function, File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution, Persistent Storage Modules

Text/Reference Books:

1. Core Python Programming, Chun, J Wesley, 2nd Edition, Pearson,2010
2. Head First Python, Barry, Paul, 2nd Edition, O Rielly, 2010.
3. Learning Python, Lutz, Mark, 4th Edition, O Rielly, 2009.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

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Semester I **MCA (CTIS)**

MCA 103: DATA STRUCTURES AND ALGORITHMS

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: This course will teach you the necessary theory and applications to properly understand the advanced algorithms and data structures that are critical to various problems and how to implement them.

COURSE OUTCOME: The student would be able:

CO 1. Explain the basics of data structure.
CO 2. Solve problems using trees.
CO 3. Implement the sorting.
CO 4. Implement and develop graphs.
CO 5. Implement and develop algorithms.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Introduction to Data Structure	5
2	Trees	8
3	Sorting	5
4	Graphs	6
5	Algorithms	8

Detailed Syllabus

Unit 1: Problem solving concepts, ADT, Stack, Operations on stack: Infix, prefix and postfix notations, Conversion of an arithmetic expression from Infix to postfix, Applications of stacks, Queue, Array representation of queue, Types of queue: Simple queue, Circular queue, Double ended queue (deque), Priority queue, Operations on all types of Queues, List, Components of linked list, Representation of linked list, Advantages and Disadvantages of linked list. Types of linked list: Singly linked list, doubly linked list, Circular linked list, Operations on singly linked list: creation, insertion, deletion, search and display.

Unit 2: Preliminaries, Binary Trees, Binary Search Trees, AVL Trees, Tree Traversals, Hashing, Hash Function, Hash families Separate Chaining, Open addressing.

Unit 3: Basic Search Techniques: Sequential search: Iterative and Recursive methods, Binary search: Iterative and Recursive methods, Preliminaries, Insertion Sort, Shell sort, Heap sort– Merge sort–Quick sort– External Sorting, Topological Sort.

Unit 4: Graph connectivity, Random walks on graph, online paging algorithm, adversary models.

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Unit 5: Randomized algorithm, a min-cut algorithm, Random treaps, Mulmuley games, Markovs chains.

Text/Reference Books

1. Goodrich Michael T, "Data Structures and Algorithms in Python ", Wiley publication, 2016.
2. Rance D.Neclase, "Data Structures and Algorithms in Python", Wiley Publication (2016)
3. E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, University Press, 2009.
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Third Edition, Pearson Education, Asia.2007.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	–	2	–	–	–	3	–	1	–	–	–	–
CO2	–	–	3	–	–	2	–	1	–	–	–	–
CO3	–	1	–	–	–	–	–	–	–	–	–	–
CO4	–	–	–	3	–	–	–	–	–	–	–	–
CO5	2	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

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Semester I **MCA (CTIS)**

MCA 104: OBJECT ORIENTED PROGRAMMING USING C++

3L+0T+0P+3C **MM: 100**

COURSE OVERVIEW AND OBJECTIVES: To understand the fundamentals of Object Oriented programming concept using C++. It includes defining the classes, invoking methods using class libraries.

COURSE OUTCOME

The student would be able:

CO 1: Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.

CO 2: Understand dynamic memory management techniques using pointers, constructors, destructors, etc

CO 3: Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.

CO 4: Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.

CO 5: Demonstrate the use of various OOPs concepts with the help of programs.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	5
2	C++ basics	6
3	Dynamic memory allocation	7
4	Polymorphism	8
5	Virtual functions	7

Detailed Syllabus:

Unit 1: Different paradigms for problem solving, need for OOP, differences between OOP and Procedure oriented programming, Abstraction, Overview of OOP principles, Encapsulation, Inheritance and Polymorphism.

Unit 2: **C++ Basics**: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References. Flow control statement- if, switch, while, for, do, break, continue, goto statements. Functions, Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions.

Unit 3: Dynamic memory allocation and de-allocation operators-new and delete, Preprocessor directives. C++ Classes And Data Abstraction: Class definition, Class structure, Class objects, Class

scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.

Unit 4: **Polymorphism** - Function overloading, Operator overloading, Generic programming necessity of templates, Function templates and class templates. Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

Unit 5: **Virtual Functions And Polymorphism** - Static and Dynamic bindings, Base and Derived class virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

Text/Reference Books:

1. Problem solving with C++, The OOP, 4th Edition, Walter Savitch, Pearson Education.
2. C++, The Complete Reference, 4th Edition, Herbert Schildt, TMH.
3. C++ Primer, 3rd Edition, S.B.Lippman and J.Lajoie, Pearson Education.
4. The C++ Programming Language, 3rd Edition, B.Stroutstrup, Pearson Education.
5. Object Oriented Programming in C++, 3rd Edition, R.Lafore, Galigotia Publications pvt ltd.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	1	-	-	-	-	-	-	-	-	-
CO2	-	2	2	-	-	-	-	-	-	-	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-
CO4	-	2	3	-	-	-	-	-	-	-	-	-
CO5	-	1	2	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	3	-	-
CO3	2	-	-
CO4	3	-	-
CO5	2	-	-

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Semester I

MCA (CTIS)

MCA 105: SOFTWARE ENGINEERING

3L+0T+0P+3C

MM:100

COURSE OVERVIEW AND OBJECTIVES: Understanding of software engineering principles of designing, testing and implementation details

COURSE OUTCOME

The student would be able to:

CO 1: Understand Software characteristics, Software components, Software applications
CO 2: Basic understanding of Models for Requirements analysis
CO 3: understand Overview of SA/SD Methodology
CO 4: understand Software testing strategies and Software Maintenance
CO 5: understand Project planning and Project scheduling with Quality Assurance

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	6
2	Software requirement specification	7
3	System design	5
4	Testing	6
5	Software project management	7

Detailed Syllabus

Unit 1: Introduction: Introduction to software Engineering, Software characteristics, Software components, Software applications, Software Engineering Principles, Software metrics and measurement, monitoring and control. Software development life-cycle, Water fall model, prototyping model, Incremental model, Iterative enhancement Model, Spiral model.

Unit 2: Software Requirement Specification: Requirements Elicitation Techniques, Requirements analysis, Models for Requirements analysis, requirements specification, requirements validation.

Unit 3: System Design: Design Principles: Problem partitioning, abstraction. Top down and bottom up – design, structured approach, Functional versus object oriented approach of design, design specification, Cohesiveness and Coupling. Overview of SA/SD Methodology, structured analysis, data flow diagrams, extending DFD to structure chart

Unit 4: Testing: Verification and validation, code inspection, test plan, test case specification. Level of testing: Unit, Integration Testing, Top down and bottom up integration testing, Alpha and Beta testing, System testing and debugging. functional testing, structural testing, Software testing strategies. Software Maintenance: Structured Vs unstructured maintenance, Maintenance Models, Configuration Management, Reverse Engineering, Software Re-engineering

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Unit 5: Software Project Management: Project planning and Project scheduling. Software Metrics: Size Metrics like LOC, Token Count, and Function Count. Cost estimation using models like COCOMO. Risk management activities, Software Reliability and Quality Assurance: Reliability issues, Reliability metrics, reliability models, Software quality, ISO 9000 certification for software industry, SEI capability maturity model.

Text / Reference Books:

1. R.S. Pressman, Software Engineering: A Practitioner's Approach, McGraw-Hill, Ed 7, 2010.
2. P. Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House, Edition 3, 2011.
3. R. Mall, Fundamentals of Software Engineering, Prentice-Hall of India, 3rd Edition, 2009.
4. Sommerville, Software engineering (9th edition), Addison Wesley, 2010

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	2	2	1	-	-	-	-	-	-	-
CO2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	-	-	-	2	-	-	-	-	-	-	-	-
CO4	-	-	1	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	1	-
CO2	-	2	-
CO3	-	2	-
CO4	-	1	-
CO5	-	3	-

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Semester I **MCA (CTIS)**

MCA 106: INTRODUCTION TO CLOUD TECHNOLOGY

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Understand the cloud concepts and architecture

COURSE OUTCOME

The student would be able to:

CO 1: Study importance of Cloud computing, various deployment and Service models.
CO 2: Analyse three Layered Architectural Requirement of Cloud computing.
CO 3: Study Comparative Analysis of Requirement at various layers.
CO 4: Understand various threats and security issues of cloud computing with solutions.
CO 5: Study how virtualization improves performance and capacity of cloud services.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Understanding cloud computing	6
2	Cloud computing technology	7
3	Fault Tolerance	6
4	Security Management in Cloud	5
5	Virtualization	5

Detailed Syllabus:

Unit 1: Understanding cloud computing
Introduction to Cloud Computing -Benefits and Drawbacks - Types of Cloud Service Development - Deployment models

Unit 2: Cloud Architecture Technology and Architectural Requirements
The Business Case for Clouds -Hardware and Infrastructure – Accessing the cloud – Cloud Storage – Standards- Software as a Service – Discovering Cloud Services Development tools. Three Layered Architectural Requirement - Provider Requirements - Service Centric Issues - Interoperability – QoS.

Unit 3: Fault Tolerance
Fault Tolerance - Data Management Storage and Processing – Virtualization Management - Scalability - Load Balancing - Cloud Deployment for Enterprises - User Requirement - Comparative Analysis of Requirement.

Unit 4: Security Management in Cloud Security Management Standards - Security Management in the Cloud Availability Management – SaaS Availability Management - PaaS Availability Management – IaaS Availability Management - Access Control - Security Vulnerability, Patch, and Configuration Management – Privacy in Cloud- The Key Privacy Concerns in the Cloud - Security in Cloud Computing

Unit 5:Virtualization Objectives - Benefits - Virtualization Technologies – Data Storage Virtualization – Storage Virtualization – Improving Availability using Virtualization - Improving Performance using Virtualization

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Text /Reference Books:

1. David S Linthicum, "Cloud Computing and SOA Convergence in your Enterprise A Step by Step Guide", Addison Wesley Information Technology Series.
2. Anthony T Velte, Toby J.Velte, Robert Elsenpeter, "Cloud computing A Practical Approach ", Tata McGraw Hill Publication
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy
4. An Enterprise Perspective on Risks and Compliance" , O'Reilly Publications, First Edition
5. Michael Miller, "Cloud Computing – Web-Based Applications that Change the Way You Work and Collaborate Online", Pearson Education, New Delhi, 2009.
6. Cloud Computing Specialist Certification Kit – Virtualization Study Guide

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	3	-	1	-	-	1	-	-	-	-
CO2	-	1	-	-	-	-	-	-	-	-	-	-
CO3	-	-	1	-	-	-	-	-	-	-	-	-
CO4	-	3	-	2	-	-	-	-	-	-	-	-
CO5	-	-	-	-	1	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	3	-	-
CO3	1	-	-
CO4	1	-	-
CO5	2	-	-

Semester I **MCA (CTIS)**

MCA 107: BASIC PROGRAMMING LAB

0L + 0T + 4P + 2C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To introduce students about practical knowledge of programming in python exercises with functions, lists and file-input/output.

COURSE OUTCOME: After completion of this course the students will be able to:

CO 1. Write, Test and Debug Python Programs
CO 2. Use Conditionals and Loops for Python Programs
CO 3. Use functions and represent Compound data using Lists, Tuples and Dictionaries
CO 4. Use various applications using python
CO 5. Develop the ability to write database applications in Python

List of Experiments:

Basic Calculation:

1. Write a python program to display your Name, address and city in different lines.
2. Write a python program to perform all arithmetic operations.
3. Write a python program to convert the Fahrenheit into centigrade. Formula c= (F-32)/1.8
4. Write a python program to calculate the simple interest.
5. Write a python program to calculate the compound interest.
6. Write a program in python to display sum of first N natural numbers.
7. Write a python program to find the roots of the quadratic equation.

Conditional Statements

1. Write a Python – program which used to determine type of triangle based on sides. Measure of sides input by the user. To check whether the triangle is isosceles, scalene or equilateral triangle. Hint: If all the sides are equal than equilateral, If any two sides are equal than isosceles otherwise scalene.
2. Write a program in python to which allow user to enter any arithmetic operator (+ - * /) and two integer values and display result according to selection of operator.
3. Write a program in python to calculate gross salary of employee using : 1. Gross Salary = Basic Pay + DA + HRA – PF. 2. DA = 30% If Basic Pay < 5000 otherwise DA = 45% of the Basic Pay. 3. HRA = 15% of Basic Pay. 4. PF = 12% of Basic Pay. Only basic pay will input by the user. Display Gross salary – DA – HRA – PF and basic salary
4. Student should fulfill the following criteria for admission: Mathematics >= 50 Physics >= 45 Chemistry >= 60 Total of all subject >= 170 OR Total of Mathematics + Physics >= 120 Accept the marks of all the three subjects from the user and check if the student is eligible for admission.
5. Write a program in python for grade calculation using if...else if ladder and switch Statement. Accept marks of 3 subjects calculate total and based on it calculate Grade.

Loop Programs

1. Program to display first N prime numbers. N is input by the user.
1. Program to display A to Z in upper case or lower case according to user selection.

2. Program which used to print A to Z and Z to A.
3. Program which ask for party to user until the user say yes (Using While)
4. Program which ask for party to user until the user say yes (Using Do While)
1. Program which check that whether the given number is palindrome or not.
2. Program to check that the given number is Armstrong or not.
3. Program which will display next nearest prime number of given integer number. For example next nearest prime of 5 is 7, for 8 is 11, for 7 is 11 (Using Do while)

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	–	–	1	–	–	1	1
CO2	3	3	2	2	3	–	–	1	–	–	–	1
CO3	2	3	3	2	2	–	–	–	–	–	1	–
CO4	2	2	3	3	3	–	–	1	–	–	–	1
CO5	2	3	2	2	2	–	–	–	–	–	1	–

CO-PSO Mapping

CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	–
CO-4	3	2	–
CO-5	3	2	1

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Semester I **MCA (CTIS)**

MCA 108: OBJECT ORIENTED PROGRAMMING USING C++ LAB

0L + 0T + 4P + 2C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: To understand the fundamentals of Object Oriented programming concept using C++. It includes defining the classes, invoking methods using class libraries.

COURSE OUTCOME
The student would be able:

CO1: Articulate the principles of object-oriented problem solving and programming.

CO2: Outline the essential features and elements of the C++ programming language.

CO3: Explain programming fundamentals, including statement and control flow and recursion.

CO4: Apply the concepts of class, method, constructor, instance, data abstraction, function abstraction, inheritance, overriding, overloading, and polymorphism.

CO5: Program using objects and data abstraction, class, and methods in function abstraction.

List of Experiments:

1. Create a user defined function (any) and use it inside the program.
2. Implement "call by value" & "call by reference " function call techniques by using any user defined functions.
3. Implement the working of classes and objects by using any real world object.
4. Create a Stack object model in C++ & also make use of default and parameterized constructor to make the class more flexible in use.
5. Make all the member functions, including constructors, non-inline in the above class.
6. Create any user defined class using the concept of static data and member functions.
7. Create a Class or program implementing the concept of passing and returning object to/from member functions.
8. WAP to implement polymorphism through function overloading (Area of different shapes).
9. Create a user defined type Complex and do all the Complex number arithmetic. And also make use of operator overloading.
10. Implement single level inheritance by using Student and Marks class.
11. Implement multilevel inheritance by using the Stack class.
12. Demonstrate the calling mechanism of constructors and destructors in Multilevel Inheritance.
13. Create generic Stack model for storing different types of data.
14. Create a user defined type Matrix and perform all matrix operations. Also make use of operator overloading.

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15. Implement the concept of Abstract classes and virtual functions by using Shape, Rectangle and Triangle class.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	1	-	-	-	-	-	-	-	-	-
CO2	-	2	2	-	-	-	-	-	-	-	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-
CO4	-	2	3	-	-	-	-	-	-	-	-	-
CO5	-	1	2	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	3	-	-
CO3	2	-	-
CO4	3	-	-
CO5	2	-	-

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Semester I **MCA (CTIS)**

MCA 109: SOFTWARE ENGINEERING LAB

0L + 0T + 4P + 2C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Understanding of software engineering principles of designing, testing and implementation details

COURSE OUTCOME
The student would be able to:

CO1: understand practice software engineering techniques

CO2: Document all the requirements as specified by customer in Software Requirement Specification

CO3: Design sequence diagrams for project

CO4: Design Data Flow Diagram for the project

CO5: Design at least 10 test cases for each module.

List of Experiments:
In this lab first 8 experiments are to practice software engineering techniques. Use any open source CASE tool. Many of them are available at www.sourceforge.net. You can choose any other CASE tool, as per choice.

Language: C++/ JAVA
Design Approach: Object Oriented

These designing can be done on any automation system e.g. library management system, billing system, payroll system, bus reservation system, gas agency management system, book-shop management system, students management system.

1. Do feasibility study?
2. Document all the requirements as specified by customer in Software Requirement Specification
3. Design sequence diagrams for project
4. Design Collaboration diagram
5. Design Data Flow Diagram for the project
6. Design Entity Relation Diagram for the project
7. Design Class diagram
8. Design at least 10 test cases for each module.
9. Code and test the project, which you have designed in last 8 labs.

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CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	2	2	1	-	-	-	-	-	-	-
CO2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	-	-	-	2	-	-	-	-	-	-	-	-
CO4	-	-	1	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	1	-
CO2	-	2	-
CO3	-	2	-
CO4	-	1	-
CO5	-	3	-

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TEACHING AND EXAMINATION SCHEME FOR MCA

(Specialization in Cloud Technology and Information Security)

SEMESTER II

Course code	Course Type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCA 201	PCC	Java Programming	3	1	-	4	4
MCA 202	PCC	Design and Analysis of Algorithms	3	1	-	4	4
MCA 203	PCC	Database Management System	3	-	-	3	3
MCA 204	PCC	Computer Networks	3	-	-	3	3
MCA*	PEC	Program Elective I	3	-	-	3	3
MCA*	PEC	Program Elective II	3	-	-	3	3
MCA 205	PCC	Java Programming Lab	-	-	4	4	2
MCA 206	PCC	Design and Analysis of Algorithms Lab	-	-	4	4	2
MCA 207	PCC	Database Management System Lab	-	-	4	4	2
TOTAL			**18**	**2**	**12**	**32**	**26**

CTIS - Cloud Technology & Information Security

L*-Lecture*, T*-Tutorial, P*-Practical

Course Code	Program Elective I
MCACT 201	Cloud Architectural Patterns
MCACT 202	Cryptography
MCACT 203	PowerShell Scripting
MCACT 204	Ethical Hacking

Course Code	Program Elective II
MCACT 205	Information & Network Security
MCACT 206	Computer Graphics and Visualization
MCACT 207	Distributed Operating Systems
MCACT 208	Advance Computer Networks

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Semester II **MCA (CTIS)**

MCA 201: JAVA PROGRAMMING

3L+1T+0P+4C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand JAVA programming constructs

COURSE OUTCOME

The student would be able to:

CO 1: Introduction part of Java Programming.
CO 2: Be competent with writing computer programs to implement given simple programs.
CO 3: Describe Packages and Interfaces.
CO 4: Describe Exception Handling and How we can handle it.
CO 5: Be familiar with reading and programming for applet.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Java	6
2	Control statements	6
3	Objects and classes	7
4	String handling	6
5	Concurrency	8

Detailed Syllabus

Unit 1: Java - Introduction to Object Orientated Programming, Abstraction, Object Oriented Programming Principles, Features of JAVA, Introduction to Java byte code, Java Virtual machine.
PROGRAM ELEMENTS: Primitive data types, variables, assignment, arithmetic, short circuit logical operators, Arithmetic operators, bit wise operators, relational operators, Boolean logic operators, the assignment operators, operator precedence, Decision and control statements, arrays.

Unit 2: Control Statements - Java's Selection Statements, if statement, switch statement, Iteration Statements, while, do-while, for, for-each, Nested Loops, Jump Statements, Using break, Using continue, return.

Unit 3: Objects And Classes - Objects, constructors, returning and passing objects as parameter, Nested and inner classes, Single and Multilevel Inheritance, Extended classes, Access Control, usage of super, Overloading and overriding methods, Abstract classes, Using final with inheritance.
PACKAGE AND INTERFACES: Defining package, concept of CLASSPATH, access modifiers, importing package, Defining and implementing interfaces.

Unit 4: String Handling - String constructors, special string operations, character extraction, searching and comparing strings string Buffer class.
Exception Handling: Exception handling fundamentals, Exception types, uncaught exceptions, try, catch and multiple catch statements. Usage of throw, throws and finally .FILE HANDLING: I/O streams, File I/O.

Unit 5: Concurrency - Processes and Threads, Thread Objects, Defining and Starting a Thread, Pausing Execution with Sleep, Interrupts, Joins, Synchronization. APPLET: Applet Fundamentals, using paint method and drawing polygons.

Text/Reference Books:

1. Herbert Schildt: JAVA 2 - The Complete Reference, TMH, Delhi
2. Deitel: How to Program JAVA, PHI
3. U.K. Chakraborty and D.G. Dastidar: Software and Systems – An Introduction, Wheeler Publishing, Delhi.
4. Joseph O'Neil and Herb Schildt: Teach Yourself JAVA, TMH, Delhi.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	2	3	-	1	-	-
CO2	-	1	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

Semester II **MCA (CTIS)**

MCA 202 DESIGN & ANALYSIS OF ALGORITHMS

3L+1T+0P+4C **MM :100**

COURSE OVERVIEW AND OBJECTIVES: Understand the various algorithms and its applications

COURSE OUTCOME

The student would be able to:

CO 1: Understand asymptotic notations to analyze the performance of algorithms.

CO 2: Identify the differences in design techniques and apply to solve optimization problems.

CO 3: Solve pattern matching problems, by choosing the appropriate algorithm design technique for their solution and justify their selection.

CO 4: Understand Randomized algorithms and network flow problem.

CO 5: Analyze deterministic and nondeterministic algorithms to solve complex problems.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Background	5
2	Dynamic programming	6
3	Pattern matching algorithms	6
4	Randomized algorithms	7
5	Problem classes np, np-hard and np-complete	7

Detailed Syllabus

Unit 1: Background: Algorithm Complexity and Order Notations and Sorting Methods.

Divide And Conquer Method: Binary Search, Merge Sort, Quick sort and strassen's matrix multiplication algorithms.

Greedy Method: Knapsack Problem, Job Sequencing, Optimal Merge Patterns and Minimal Spanning Trees.

Unit 2: Dynamic Programming: Matrix Chain Multiplication. Longest Common Subsequence and 0/1 Knapsack Problem

Branch and Bound: Traveling Salesman Problem and Lower Bound Theory. Backtracking Algorithms and queens problem

Unit 3: Pattern Matching Algorithms - Naïve and Rabin Karp string matching algorithms, KMP Matcher and Boyer Moore Algorithms.

Assignment Problems: Formulation of Assignment and Quadratic Assignment Problem.

Unit 4: Randomized Algorithms - Las Vegas algorithms, Monte Carlo algorithms, randomized algorithm for Min-Cut, randomized algorithm for 2-SAT. Problem definition of Multi commodity flow, Flow shop scheduling and Network capacity assignment problems.

Unit 5: Problem Classes NP, NP-Hard and NP-Complete - Definitions of P, NP-Hard and NP-Complete Problems. Decision Problems, Cook's Theorem, Proving NP-Complete Problems - Satisfiability problem and Vertex Cover Problem. Approximation Algorithms for Vertex Cover and Set Cover Problem

Text/Reference Books:

1. Coreman, Rivest, Lisserson, : "Algorithm", PHI.
2. Basse, "Computer Algorithms: Introduction to Design & Analysis", Addision Wesley.
3. Horowitz & Sahani, "Fundamental of Computer Algorithm", Galgotia.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	2	-	-	-	-
CO5	-	-	-	-	-	-	-	-	1	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	1	-
CO3	-	1	-
CO4	-	2	-
CO5	-	2	-

Semester II **MCA (CTIS)**

MCA 203: DATABASE MANAGEMENT SYSTEM

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Understanding and implementation of data storage and organization and its applications

COURSE OUTCOME

The student would be able to:

CO 1: Describe the fundamental elements of database management systems.

CO 2: Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL

CO 3: understand Query Language.

CO 4: evaluate database anomalies and normalization

CO 5: understand transaction concepts, data mining and warehousing

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	5
2	Relational model	6
3	Relational database design	6
4	Internet databases	7
5	Advanced topics	8

Detailed Syllabus

Unit 1: Introduction - Database Systems versus File Systems, View of Data, Data Models, database languages, Database Users and Administrators. Transaction Management, Decision Support Systems, Components of a Database management System, Distributed Processing and Client- Server Architecture, Entity-Relationship Model – Basic Concepts, Constraints, Keys, Design Issues, E-R Diagrams

Unit 2: Relational Model - Structures of relational databases, Integrity Constraints, Logical database Design, Tables, Views, and Data Dictionary. Relational Algebra, Relational Calculus. SQL – Basic Structures, Query Handling, Embedded SQL, Open Database Connectivity (ODBC), Java Database Connectivity (JDBC), Triggers, Security and Authorization. Query By Example (QBE), User Interfaces and Tools, Forms and Graphical User Interfaces. Report Generators. Overview of Relational Query Optimization

Unit 3: Relational Database Design - Functional Dependencies, Multi-valued Dependencies, Normal Forms, Decomposition into Normalized Relations, Physical Database Design – File Structures. Object-Relational Databases – Nested Relations, Complex Data types, Object-Relational Features in SQL:1999.

Unit 4: Internet Databases - World Wide Web, Client Side Scripting and Applets, Web Servers and Sessions, Services, Server Side Scripting. XML – Structure of XML Data, XML Document Schema, XQuery, Storage of XML Data, XML Applications.

Unit 5: Advanced Topics - Fundamental Concepts of Transaction Management, Concurrency Control, Recovery Systems, Data Analysis and OLAP. Introduction to Data Mining, Data Farming, Data Warehousing, Spatial and Geographic Databases, Temporal databases and Multimedia Databases.

Text / Reference Books:

1. Date C J, " An Introduction to Database Systems", Addision Wesley
2. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill
3. Elmasri, Navathe, "Fudamentals of Database Systems", Addision Wesley
4. Leon & Leon,"Database Management Systems", Vikas Publishing House
5. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications
6. Majumdar & Bhattacharya, "Database Management System", TMH

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	1	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-
CO5	-	1	2	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	-	1	-
CO3	-	3	-
CO4	-	2	-
CO5	1	-	-

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Semester II **MCA (CTIS)**

MCA 204: COMPUTER NETWORKS

3L + 0T + 0P + 3C **MM 100**

COURSE OBJECTIVE: To understand the basics of networking and its underlying principles. This course enables learners to understand computer networking concepts, how they work, operate, communicate with ports and Protocols. Standards and models associated with networking technology and their troubleshooting mechanisms.

COURSE OUTCOME:

After completion of the course the student will be able to:

CO1: Explain the types of Network and its architecture

CO2: Identify the function of each layer in OSI and TCP/IP Models

CO3: Discuss the functionality of networking devices

CO4: Demonstrate the IPv4 and IPv6 addressing types

CO5: Practice Network troubleshooting.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Networking Fundamentals	5
2	Basics of Network, Transport and Application Layers	6
3	Basics of Network Devices	5
4	WAN Technology	6
5	Troubleshooting Network	6

Detailed syllabus:

Unit 1: Networking Fundamentals Basics of Network & Networking, Advantages of Networking, Types of Networks, Types of Network Architecture, Workgroup Vs. Domain. Network Topologies, Types of Topologies, Logical and physical topologies, selecting the Right Topology, Types of Transmission Media, Communication Modes, Wiring Standards and Cabling, media connectors, Introduction of OSI model, Functions of the seven layers, Introduction of TCP/IP Model, Comparison between OSI model & TCP/IP model.

Unit 2: Basics of Network Devices Network Devices- NIC- functions of NIC, installing NIC, Hub, Switch, Bridge, Router, Gateways, And Other Networking Devices, Repeater, CSU/DSU, Modem, Ethernet standards, Ethernet Components, Point-to-Point Protocol, Address Resolution Protocol, Message format, transactions, Benefits of Wireless Technology, Types of Wireless Networks, Wireless network Components, wireless LAN standards, wireless security Protocols.

Unit 3: Basics of Network, Transport and Application Layers Network Layer: Internet Protocol (IP), IP standards, versions, functions, The IPv4 and IPv6 Datagram Format, IPv4 addressing, IPv4 Subnetting, CIDR and VLSM, IPv6 Addressing, , Internet Control Message Protocol , Internet Group Management Protocol ,Introduction to Routing and Switching concepts, Transport Layer: Transmission Control Protocol(TCP), User Datagram Protocol (UDP), Overview of Ports & Sockets, Application Layer Protocols

Unit 4: WAN Technology Introduction to WAN, WAN Switching techniques, connecting to the Internet, Satellite-Based Services, Cellular Technologies, Technologies used for Connecting LANs, Remote Access Connections and technologies, Authentication and Authorization, Tunnelling and Encryption Protocols, Security Appliances and Security Threats.

Unit 5: Troubleshooting Network Trouble Shooting Networks: Command-Line Interface Tools, Network and Internet Troubleshooting, Troubleshooting Model, identify the affected area, probable cause, implement a solution, test the result, recognize the potential effects of the solution, document the solution, Using Network Utilities: ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat, Hardware trouble shooting tools, system monitoring tools.

Text/ Reference Books:

1. Data Communication And Networking(Sie), Forouzan, TMH
2. Computer Network, Tanenbaum, Pearson
3. CCNA Cisco Certified Network Associate: Study Guide (With CD) 7th Edition (Paperback), Wiley India, 2011
4. CCENT/CCNA ICND1 640-822 Official Cert Guide 3 Edition (Paperback), Pearson, 2013
5. Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback), Pearson, 2008
6. CCNA Exploration Course Booklet: Routing Protocols and Concepts, Version 4.0 (Paperback), Pearson, 2010

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	2	3	-	1	-	-
CO2	-	1	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

Semester II **MCA (CTIS)**

MCA 205: JAVA PROGRAMMING LAB

0L+0T+4P+2C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand JAVA programming constructs

COURSE OUTCOME: The student would be able to:

CO1: write classes and functions programming

CO2: Understand and implement interfaces

CO3: Implementation of packages

CO4: Implementation of exception handling

CO5: Understand JDBC

Programs in JAVA:

1. Creation of classes and use of different types of functions.
2. Count the number of objects created for a class using static member function.
3. Write programs on interfaces and packages.
4. Write programs using function overloading.
5. Programs using inheritance
6. Programs using IO streams.
7. Programs using files.
8. Write a program using exception handling mechanism.
9. Programs using AWT
10. Programs on swing.
11. Programs using JDBC

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	2	3	-	1	-	-
CO2	-	1	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

Semester II **MCA (CTIS)**

MCA 206: DESIGN AND ANALYSIS OF ALGORITHMS LAB

0L+0T+4P+2C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand the various algorithms and its applications

COURSE OUTCOME

The student would be able to:

CO 1: Understand asymptotic notations to analyze the performance of algorithms.

CO 2: Identify the differences in design techniques and apply to solve optimization problems.

CO 3: Solve pattern matching problems, by choosing the appropriate algorithm design technique for their solution and justify their selection.

CO 4: Understand Randomized algorithms and network flow problem.

CO 5: Analyze deterministic and nondeterministic algorithms to solve complex problems.

LIST OF EXPERIMENTS:

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n.
2. Sort a given set of elements using merge sort method and determine the time required to sort the elements. Repeat the experiment for different of values of n.
3. Write a program to obtain the topological ordering of vertices in a given digraph.
4. Implement travelling salesman problem.
5. Implement the knapsack problem (0/1).
6. Print all the nodes reachable from a given starting node in a digraph using BFS method.
7. Check whether a given graph is connected or not using DFS method.
8. Write a program to implement binary search using divide and conquer technique
9. Write a program to implement insertion sort using decrease and conquer technique
10. Find minimum cost spanning tree of a given undirected path using a Prim's algorithm.
11. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	2	-	-	-	-
CO5	-	-	-	-	-	-	-	-	1	-	-	-

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CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	1	-
CO3	-	1	-
CO4	-	2	-
CO5	-	2	-

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Semester II **MCA (CTIS)**

MCA 207: DATABASE MANAGEMENT SYSTEM LAB

0L+0T+4P+2C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understanding and implementation of data storage and organization and its applications

COURSE OUTCOME

The student would be able to:

CO 1: write programs to store student details
CO 2: perform Database creation/ deletion, table creation/ deletion.
CO 3: Understanding Query Execution
CO 4: Able to check Validity of Query
CO 5: Designing of a database management system

List of Experiments:

Student can use MySql (preferred open source DBMS) or any other Commercial DBMS tool (MS-Access / ORACLE) at backend and C++ (preferred) Php/JAVA at front end.

1.
   a. Write a C++ program to store students records (roll no, name, father name) of a class using file handling.(Using C++ and File handling).
   b. Re-write program 1, using any DBMS and any compatible language.(C++/MySQL)
2.
   a. Write a program to take a string as input from user. Create a database of same name. Now ask user to input two more string, create two tables of these names in above database.
   b. Write a program, which ask user to enter database name and table name to delete. If database exist and table exist then delete that table.
3. Write a program, which ask user to enter a valid SQL query and display the result of that query.
4. Write a program in C++ to parse the user entered query and check the validity of query. (Only SELECT query with WHERE clause)
5. Create a database db1, having two tables t1 (id, name, age) and t2 (id, subject, marks).
   a. Write a query to display name and age of given id (id should be asked as input).
   b. Write a query to display average age of all students.
   c. Write a query to display mark-sheet of any student (whose id is given as input).
   d. Display list of all students sorted by the total marks in all subjects.
6. Design a Loan Approval and Repayment System to handle Customer's Application for Loan and handle loan repayments by depositing installments and reducing balances.
7. Design a Video Library Management System for managing issue and return of Video tapes/CD and manage customer's queries.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	1	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-
CO5	-	1	2	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	-	1	-
CO3	-	3	-
CO4	-	2	-
CO5	1	-	-

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PROGRAM ELECTIVE I

Semester II **MCA (CTIS)**

MCACT 201: CLOUD ARCHITECTURAL PATTERNS

3L+0T+0P+3C **MM: 100**

COURSE OVERVIEW AND OBJECTIVES:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud computing so that they are able to identify the vendors and assess the risk involved in cloud migration.

COURSE OUTCOME:

After completion of this course students should be able to:-

- Analyze the Cloud computing setup with its vulnerabilities and applications.
- Analyze the risks involved in migrating the existing infrastructure to cloud.
- Assess various cloud service providers.
- Broadly educate to know the impact of engineering on legal and societal issues.
- Design and develop backup strategies for cloud data based on features.

OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit
1.	Introduction to cloud and their Challenges	9
2.	Assessing applications for a cloud Migration	8
3.	Cloud Migration Business Strategy	8
4.	Total Cost of Ownership (TCO)	8
5.	Migration Process	9

Detailed Syllabus

Unit1: Introduction to cloud and their Challenges:

Cloud Migration Terminology, Digital Transformation, Cloud Migration Benefits, Cloud Migration Concerns, Time Table (Gantt chart), AWS CLOUD, Amazon EC2, Amazon S3, Amazon RDS, Amazon Elastic Cache, Amazon Elastic Map Reduce

Unit 2:Assessing applications for a cloud Migration:

Application Design Complexity, Integration Complexity, The Host OS, The Application Database, SWOT analysis: The Usage of SWOT Analysis, Strengths, Weaknesses, Opportunities, Threats

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Unit 3: Cloud Migration Business Strategy:

Establishing the Migration-Architect Role, Cloud Integration Level, Single Cloud or Multi-Cloud, Setting the Cloud KPIs, Establishing Performance Baselines, Prioritizing Migration Components, Performing any Necessary Refactoring, Creating a Data-Migration Plan, Switching Over Production, Reviewing the Application Resource

Unit 4: Total Cost of Ownership (TCO):

Ensuring Costs Optimization on AWS, Cloud Performance: Supervising tuning and capacity delivery, Root cause analysis, Restoring service and SLA, Tune, Increasing Resource Allocation, Producing and maintaining the capacity plan

Unit 5: Migration Process:

Migrate ERP VM to AWS, VM Import/Export – VoIP Solution, Migrate Survey Solution to AWS

Textbooks/Reference Books:

1. CLOUD ESSENTIALS:Kirk Hausman, Susan L. Cook, Telmo Sampaio, 2013 Edition,Wiley
2. Cloud Computing for Dummies:Judith Hurwitz , Robin Bloor ,Marcia Kaufman , Fern Halper, 2010 Edition,Wiley Publishing
3. Cloud Computing: Concepts, Technology & ArchitectureErl,2014 Edition, Pearson Education

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	–	1	3	–	–	–	–	–	–	–
CO2	2	–	3	2	1	–	–	–	–	–	–	–
CO3	2	1	–	1	3	–	–	–	–	–	–	–
CO4	1	1	–	1	2	–	–	–	–	–	–	–
CO5	1	2	–	3	2	–	–	–	–	–	–	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	–
CO-3	2	2	–
CO-4	2	3	2
CO-5	3	3	–

Semester II **MCA (CTIS)**

MCACT 202: CRYPTOGRAPHY

3L+0T+0P+3C **MM: 100**

COURSE OVERVIEW AND OBJECTIVES:

- To understand basics of Cryptography and Network Security.
- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
- To understand various protocols for network security to protect against the threats in the networks.

COURSE OUTCOME:

After completion of this course students should be able to:-

CO 1. learn about how to maintain the Confidentiality, Integrity and Availability of a data
CO 2. Provide security of the data over the network.
CO 3. Do research in the emerging areas of cryptography and network security.
CO 4. Implement various networking protocols.
CO 5. Protect any network from the threats in the world.

OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit
1.	Introduction to Cryptography and Block Ciphers	9
2.	Confidentiality and Modular Arithmetic	8
3.	Public key cryptography and Authentication requirements	8
4.	Integrity checks and Authentication algorithms	8
5.	IP Security and Key Management	9

Detailed Syllabus

UNIT 1 (Introduction to Cryptography and Block Ciphers): Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and blockciphers - Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion and diffusion - fiestal structure - data encryption standard(DES) - strength of DES - differential and linearcrypt analysis of DES - block cipher modes of operations - triple DES – AES.

Unit 2 (Confidentiality and Modular Arithmetic) : Confidentiality using conventional encryption - traffic confidentiality - key distribution - random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm - Chinese Remainder theorem - discrete algorithms.

Unit 3 (Public key cryptography and Authentication requirements): Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS.

Unit 4 (Integrity checks and Authentication algorithms): MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME.

Unit 5 (IP Security and Key Management): IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. Unit VI (Web and System Security) Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.

Text Books / Reference Books

1. William Stallings, "Crpyptography and Network security Principles and Practices", Pearson/PHI.
2. Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", Pearson.
3. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
4. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Semester II **MCA (CTIS)**

MCACT 203 POWERSHELL SCRIPTING

3L+ 0T+0 P+3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- Build higher functions
- Use cmdlets plus Microsoft .NET Framework in windows PowerShell
- Write Controller script

COURSE OUTCOME:

After completion of this course students should be able to

CO 1: Configure and manage networks and computers from the command line.

CO 2: Perform and automate common systems administration tasks using Linux shell scripts and Windows PowerShell scripts.

CO 3: Access and manipulate different types of data using scripts, write, run, test, and troubleshoot scripts.

CO 4: Monitor activities on networks and systems using logging techniques.

CO 5: Measure system performance and produce reports using scripts and examine various system commands and interfaces in the Linux and Windows environments.

OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit
1.	Introduction to PowerShell	10
2.	The PowerShell Pipeline, Scripts and Syntax	9
3.	Security	8
4.	Script Flow Control Statements	7
5.	Error Handling	8

Detailed Syllabus

Unit 1: Introduction to PowerShell

The Basics: What is PowerShell, PowerShell Cmdlets, PowerShell Snapins, PowerShell Modules, PowerShell Remoting, Navigating in PowerShell

Unit 2: The PowerShell Pipeline, Scripts and Syntax

Pipelines, Scripts, Syntax, Output and Script Blocks, Variables and Data Types, Variable Scopes, and Collections: Variables and Data Types: Variable Scopes, Collections

Unit 3: Security

Script Execution, Signing Scripts, Requesting Credentials and Using Secure Strings, Securing Remote

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Unit 4: Script Flow Control Statements

Foreach and For, While / Do While / Do Until, If / Switch, Break /Continue, Functions, Filters and Modules: Functions and Filters, Scripting with Functions and Parameters, Modules

Unit 5: Error Handling

Error Handling, Script Debugging, Administrative Uses: Manipulating files and folders, Modifying Registry Data, Working with Events, Working with Active Directory Objects, Advanced Scripting

Text / Reference Books:

1. Learn PowerShell Toolmaking in a Month of Lunches,Jeffery Hicks, Don Jones,Manning Publications
2. Windows PowerShell Cookbook: The Complete Guide to Scripting Microsoft's Command Shell,Lee Holmes,2010 Edition O'Reilly

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	–	–	1	–	–	1	1
CO2	3	3	2	2	3	–	–	1	–	–	–	1
CO3	2	3	3	2	2	–	–	–	–	–	1	–
CO4	2	2	3	3	3	–	–	1	–	–	–	1
CO5	2	3	2	2	2	–	–	–	–	–	1	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	–
CO-4	3	2	–
CO-5	3	2	1

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Semester II **MCA (CTIS)**

MCACT 204: ETHICAL HACKING

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES:

- To help students understand how ethical hacking is used as a method to prevent hacking.

COURSE OUTCOME: After completion of this course students should be able to:

CO 1. Explain the importance of ethical hacking in achieving the goals of information security.
CO 2. Differentiate the processes of vulnerability assessment from penetration testing.
CO 3. Comprehend the importance of countermeasures for managing vulnerabilities.
CO 4. Justify the need for documentation of both technical and management audiences.
CO 5. Articulate the rationale for having an adequate legal framework for dealing with hacking

OUTLINE OF THE COURSE

Unit	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Ethical Hacking	9
2.	Hacking Methodology	8
3.	Web and Network Hacking	9
4.	Report writing & Mitigation	8
5.	Ethical Hacking and Legal System	8

Detailed Syllabus

Unit 1: Introduction to Ethical Hacking

Hacking Methodology, Process of Malicious Hacking, and Foot printing and scanning: Foot printing, scanning. Enumeration: Enumeration. System Hacking and Trojans: System Hacking, Trojans and Black Box Vs. White Box Techniques.

Unit 2: Hacking Methodology

Denial of Service, Sniffers, Session Hijacking and Hacking Web Servers: Session Hijacking, Hacking Web Servers. Web Application Vulnerabilities and Web Techniques Based Password Cracking: Web Application Vulnerabilities, Web Based Password Cracking Technique

Unit 3: Web and Network Hacking

SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms, Physical Security. Linux Hacking: Linux Hacking. Evading IDS and Firewalls: Evading IDS and Firewalls.

Unit 4: Report writing & Mitigation

Introduction to Report Writing & Mitigation, requirements for low level reporting & high level reporting of Penetration testing results, Demonstration of vulnerabilities and Mitigation of issues

Unit 5: Ethical Hacking and Legal System

Overview of India's Information Technology Amendment Act 2008 (IT Act 2008) ,cyber theft and IPC sec 378, IT Act 2008 – sections 43, 65 and 66,Case Studies.

Textbooks/Reference Books:

1.Gray Hat Hacking, The Ethical Hackers Handbook,Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle,3rd Edition, McGraw Hill Education

2. CEH v9: Certified Ethical Hacker,Version 9,Study GuideSean-Philip Oriyano,Sybex

3. Hacking for Beginners: Ultimate 7 Hour Hacking Course for BeginnerS

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	2	1	3	–	2	3	3	–	–
CO2	2	1	2	2	1	3	–	3	2	3	–	–
CO3	3	1	2	2	1	1	–	3	3	3	–	–
CO4	–	–	–	–	–	–	–	3	3	3	–	–
CO5	–	–	–	–	–	–	–	–	–	2	2	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	–	–
CO-2	3	–	–
CO-3	3	–	–
CO-4	–	2	2
CO-5	–	2	2

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PROGRAM ELECTIVE II

Semester II **MCA (CTIS)**

MCACT 205: INFORMATION & NETWORK SECURITY

3L+ 0T+0 P+3C **MM 100**

Course Objective: To help students understand various characteristics of network security, threats and risks to securing network

Course Outcomes:

CO 1. The students will be able to relate fundamental concepts of information security with network and connectivity

CO 2. The students will be able to understand various characteristics of network security, threats and risks to securing network.

CO 3. The students will be able to learn important network security protocols and means of achieving an effective network security

CO 4. The students will be able to apply their understanding of network security in identifying common issues and propose suitable solutions.

CO 5. The students will be able to articulate the importance of managing the network using policies, processes and framework for effective and efficient security

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction to Network Security	5
2	Threats, Vulnerabilities and Attacks	6
3	Network Security Management	7
4	Network Security Controls	6
5	Network Management	7

Detailed Syllabus

Unit 1: Introduction to Network Security

Perimeter Security – Overview of Network Security, Access Control, Device Security, Security features on Switches, Firewall, Types of firewall, Access Management, Multifactor Authentication, Wireless LAN (WLAN) Security and Network Admission Control (NAC)

Unit 2: Threats, Vulnerabilities and Attacks

Threat; Vulnerabilities; Attacks – Application Attack, Network Attack and Mitigating & Deterring Attacks; Network Security – Security through network devices, Security through Network Technologies and Security through Network Design Elements, Administering a Secure Network

Unit 3: Network Security Management

Secure Socket Layer (SSL) – Introduction to SSL, Open SSL basics, Problems with SSL, Cryptography, Message Digits Algorithms, Digital Signature and Public Key Infrastructure (PKI); Data Privacy – IPsec VPN, Dynamic Multipoint VPN (DMVPN), Group Encrypted Transport VPN (GET VPN)

Unit 4: Network Security Controls

Network Intrusion Prevention – Overview of Intrusion Prevention System (IPS), Intrusion Detection System (IDS), Deploying IPS and IPS high Availability; host Intrusion Prevention; Anomaly Detection and Mitigation.

Unit 5: Network Management

Security Monitoring and correlation; Security Management - Security and Policy Management and Security Framework and Regulatory Compliance; Best Practices Framework, Case Studies

Text/Reference Books:

1. Network Security Bible by Eric Cole, Wiley; Second edition (2009)
2. Network Security: Private Communication in a Public World by Charlie Kaufman, Radia Perlman, Mike Speciner, Pearson Education; Second edition (15 September 2016)
3. Network Security and Administration by Adesh K. Pandey, S.K. Kataria& Sons; Reprint 2013 edition (2013)
4. Network Security: A Beginners Guide by Eric Maiwald, McGraw Hill Education; Third edition (1 November 2012)

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	-
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	1	-
CO2	-	2	-
CO3	-	3	-
CO4	-	2	-
CO5	-	3	-

Semester II **MCA (CTIS)**

MCACT 206 COMPUTER GRAPHICS AND VISUALIZATION

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand the working of graphics and visual effects

COURSE OUTCOME

The student would be able to:

CO 1: Understand computer graphics, applications
CO 2: Describe Rasterization, Scan Conversion
CO 3: Understanding of transformation, translation, scaling, rotation, reflection
CO 4: Describe Clipping and Shading concepts
CO 5: Explain Visibility, Hidden Lines and Surfaces

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	6
2	Line and circle generation	7
3	Geometric transformations	8
4	Clipping and rendering	6
5	Curves and visibility	6

Detailed Syllabus

Unit 1: Introduction -History of computer graphics, applications, physical and synthetic images, synthetic camera model, CRT, pixel, frame buffer, resolution, aspect Ratio, flicker, interlacing, raster scan and vector scan displays.

Unit 2: Line And Circle Generation –Rasterization, Scan Conversion: point, line, circle, line drawing, Digital Differential Analyzer algorithm, Bresenham's algorithm, comparison of DDA and Bresenham's Algorithm, 8-way symmetry, Mid-Point Circle Algorithm

Unit 3: Geometric Transformations- 2D coordinate system, Homogeneous coordinates affine transformations, 2D transformation, translation, scaling, rotation, reflection, shear, 2D transformation matrix, composite transformation, Inverse transformation

Unit 4: Clipping And Rendering – Point clipping, line clipping, Cohen-Sutherland algorithm, polygon clipping, Sutherland-Hodgman algorithm, polygon representation, polygon filling, flood fill, boundary fill algorithms, rendering, basic illumination model, diffuse reflection, specular reflection, phong shading, Gouraud Shading

Unit 5: Curves And Visibility – Bezier curves and surfaces, Properties of Bezier Curves, B Spline Curves, Visibility, Hidden Lines and Surfaces, Z Buffer Algorithm

Text / Reference Books:

1. Edward Angel, Interactive Computer Graphics. A Top-Down Approach Using OpenGL (fifth Edition), Pearson Education, 2008
2. Donald Hearn and Pauline Baker, Computer Graphics with OpenGL (third edition), Prentice Hall, 2003
3. F. S. Hill Jr. and S. M. Kelley, Computer Graphics using OpenGL (third edition), Prentice Hall, 2006
4. Peter Shirley and Steve Marschner, Computer Graphics (first edition), A. K. Peters, 2010

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	-	-
CO2	-	-	-	3	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	1	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	2	-
CO5	1	-	-

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Semester II **MCA (CTIS)**

MCACT 207: DISTRIBUTED OPERATING SYSTEMS

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand Distributed Systems

COURSE OUTCOME

The student would be able to:

CO 1: Apply knowledge of distributed systems techniques and methodologies.
CO 2: Explain the design and development of distributed systems and distributed systems applications.
CO 3: Use the application of fundamental Computer Science methods and algorithms in the development of distributed systems and distributed systems applications.
CO 4: Discuss the design and testing of a large software system, and to be able to communicate that design to others.
CO 5: Students will examine how existing systems have applied the concepts of distributed systems in designing large systems, and will additionally apply these concepts to develop sample systems.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Distributed deadlock detection	6
2	Deadlock detection	7
3	Distributed objects and remote invocation	6
4	Transactions and concurrency control	5
5	Distributed algorithms	8

Detailed Syllabus

Unit 1: Distributed Deadlock Detection - system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms. Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem.

Unit 2: Deadlock Detection - system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms. Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem.

Unit 3: Distributed Objects and Remote Invocation - Communication between distributed objects, Remote procedure call, Events and notifications, Java RMI case study.
Security: Overview of security techniques, Cryptographic algorithms, Digital signatures Cryptography pragmatics, Case studies: Needham Schroeder, Kerberos, SSL & Millicent.

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Unit 4: Transactions And Concurrency Control - Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control. DISTRIBUTED TRANSACTIONS: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

Unit 5: Distributed Algorithms - Introduction to communication protocols, balanced sliding window protocol, Routing algorithms, Destination based routing, APP problem, Deadlock free Packet switching, Introduction to Wave & traversal algorithms, Election algorithm-CORBA

Text/Reference Books:

1. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Ed.
2. Gerald Tel, "Distributed Algorithms", Cambridge University Press
3. William Stalling, Distributed System, Addision Wesley

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	3
CO3	-	-	1
CO4	2	-	-
CO5	1	-	-

Semester II **MCA (CTIS)**

MCACT 208: ADVANCE COMPUTER NETWORKS

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand the network infrastructure

COURSE OUTCOME: The student would be able to:

CO 1: Introduction of OSI, TCP/IP and other networks models, Network Topologies
CO 2: Describe Data Link and Access Layer
CO 3: Understanding of Virtual circuit and internetworking
CO 4: Describe wireless networks
CO 5: Explain Multimedia networking

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Computer network layer	6
2	Link layer	6
3	Logical addressing	7
4	Wireless network	7
5	VPNS	6

Detailed Syllabus

Unit 1: COMPUTER NETWORKS AND THE INTERNET: What is the Internet. The Network edge. The Network core, Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet, Switched Networks, History of Computer Networking and the Internet, Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSi Model, Internet Protocols and Addressing, Equal-Sized Packets Model: ATM. Networking Devices: Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure.

Unit 2: THE LINK LAYER AND LOCAL AREA NETWORKS: Link Layer Introduction and Services, Error-Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPL: The point-to-point Protocol, Link Virtualization. Routing and Internet Working: Network Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms. Interdomain Routing Protocols. Congestion Control at Network Layer.

Unit 3: LOGICAL ADDRESSING: IPv4 Addresses, IPv6 Addresses, Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intradomain Multicast Protocols, Interdomain Multicast Protocols, Node-Level Multicast algorithms, Transport and End-to-End Protocols: Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport layer protocols, TCP Congestion Control, Application Layer: Principles of Network Applications, The web and HTTP, file Transfer: FTP, Electronic Mail in the internet, Domain Name system (DNS), PP File sharing, socket Programming with TCP and UDP Building a Simple Web Server.

Unit 4: WIRELESS NETWORK AND MOBILE IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standards, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Optical Networks and WDM Systems: Overview of Optical Networks, Basic

Optical Networking Devices, Large-Scale Optical Switches, Optical Routers, Wavelength Allocation in Networks, Case Study: An All, Optical Switch.

Unit 5:VPNS TUNNELING AND OVERLAY NETWORKS: Virtual Private Networks (VPNs), Multiprotocol Label Switching (MPLS), Overlay Networks, **VoIP and Multimedia Networking**: Overview of IP Telephony, VoIP Signaling Protocols, Real-Time Media Transport Protocols, Distributed Multimedia Networking, Stream Control Transmission Protocol, **Mobile Ad-hoc Networks:** Overview of Wireless Ad-hoc Networks, Routing in Ad-hoc Networks, Routing Protocols for Ad-hoc Networks, **Wireless Sensor Networks:** Sensor Networks and Protocol Structures, Clustering Protocols, Routing Protocols.

Text/Reference Books:

1. Computer Networking: A Top-Down Approach Featuring the Internet, James F, Keith W.Ross, Third Edition, Pearson Education, 2007.
2. Computer and Communication Networks, NaderF, Mir, Pearson Education, 2007.
3. Guide to Networking Essentials, Greg Tomsho,Ed Tittel, David Johnson,Fifth Edition, Thomson.
4. An Engineering Approach to Computer Networking, S.Keshav, Pearson Education.
5. Campus Network Design Fundamentals, Diane Teare, Catherine Paquet, Pearson Education (CISCO Press)
6. Computer Networks, Andrew S. Tanenbaum, Fourth Edition, Prentice Hall.
7. The Internet and Its Protocols, A.Farrel, Elsevier.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	2	3	-	1	-	-
CO2	-	1	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

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TEACHING AND EXAMINATION SCHEME FOR MCA

(Specialization in Cloud Technology and Information Security)

SEMESTER-III

Course Code	Course Type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCACT 301	PCC	Storage and Data Center	3	1	-	4	4
MCACT 302	PCC	Cloud Security	3	-	-	3	3
MCA*	PEC	Program Elective III	3	-	-	3	3
MCA*	PEC	Program Elective IV	3	-	-	3	3
MCA*	PEC	Program Elective V	3	-	-	3	3
MCACT 303	PCC	Storage and Data Center Lab	-	-	4	4	2
MCACT 304	PCC	Cloud Security Lab	-	-	4	4	2
MCA 301	PSIT	Seminar	-	-	4	4	2
MCA 302	PSIT	Project Phase - I	-	-	-	8	4
		Total	**15**	**1**	**12**	**36**	**26**

L*-Lecture*, T*-Tutorial, P*-Practical

Course Code	Program Elective III
MCACT 305	Principles of Virtualization
MCACT 306	Cloud Migration
MCACT 307	Linux Administration
MCACT 308	Security Architecture

Course Code	Program Elective IV
MCACT 309	Database Security
MCACT 310	Server Security
MCACT 311	IOT Security
MCACT 312	Web Security

Course Code	Program Elective V
MCACT 313	IT Governance & Risk Management
MCACT 314	Cyber Forensics
MCACT 315	Cyber Crime & IT Law
MCACT 316	Bio Informatics

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Semester III **MCA (CTIS)**

MCACT 301: STORAGE AND DATA CENTER

3L + 1T + 0P + 4C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To impart the basic concepts of Storage systems and Datacenter environment.
- To understand concepts about RAID techniques.
- To understanding about taking backup and restoring the data with the help of Business Continuity and Disaster Recovery concepts and tools.
- To understand about Data Center Consolidation and Clustering.

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

CO 1. Analyze Storage devices and technologies.
CO 2. Summarize the advantages and functionality of NAS and SAN.
CO 3. Appreciate knowledge on Backups and Disaster Recovery.
CO 4. Describe Data Center Consolidation and its phases.
CO 5. Appreciate knowledge on design and analysis of Cluster Architecture.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction to Storage System	6
2	Storage Networking Technologies	7
3	Backup and Disaster Recovery	7
4	Data Center Consolidation	6
5	Data Center Clusters	7

Detailed Syllabus

Unit 1: Introduction to Storage System

Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing

Data Center Environment: Application, Database Management System (DBMS), Host (Compute), Connectivity, Storage, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application

Data Protection (RAID): RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison

Unit 2: Storage Networking Technologies

Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance , File-Level Virtualization.

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Fibre Channel Storage Area Networks: Fibre Channel Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN.
IP SAN and FCoE: iSCSI, FCIP, FCoE

Unit 3: Backup and Disaster Recovery

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions.
Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture.

Unit 4: Data Center Consolidation

Reasons for Data Center Consolidation: Reasons for Data Center Consolidation, Consolidation Opportunities.
Data Center Consolidation Phases: Phase 1: Study and Document the Current Environment, Phase 2: Architect the Target Consolidated Environment, Phase 3: Implement the New Architecture, Phase 4: Control and Administer the Consolidated.
Best Practices in IT: Defining Best Practices, Deploying Best Practices, Benefits of Best Practices, Systems Management Best Practices, Server Cluster Best Practices, Data Storage Best Practices, Network Management Best Practices, Documentation Best Practices, Network Diagram Documentation, Documentation Formats.

Unit 5: Data Center Clusters

Cluster Architecture: Asymmetric Two-Node Clusters, Symmetric Two-Node Clusters, Complex Cluster Configurations, Failover Policies, Best Practices.
Cluster Requirements: Required Hardware Cluster Components, Cluster Software Requirements, What Happens During Service Failover, Cluster Installation Checklist.
Designing Cluster-Friendly Applications: Automating Operations, Controlling Application Failover Time, Reducing Data Loss During Failover, Minimizing Application Failures, Designing Node-Independent Applications, Minimizing Planned Downtime, Restoring Client Connections.

Text/Reference Books:

1. Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, ISCSI, INFINIB and FOCE by Ulf Troppens.
2. Storage Management in Data Centers: Understanding, Exploiting, Tuning, and Troubleshooting Veritas Storage Foundation by Volker Herminghaus and Albrecht Scriba.
3. Blade Servers and Virtualization: Transforming Enterprise Computing While Cutting Costs by Barb Goldworm and Anne Skamarock.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

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Semester III **MCA (CTIS)**

MCACT 302: CLOUD SECURITY

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Students are able to:-

- Understand the fundamentals of cloud computing.
- Compare modern security concepts as they are applied to cloud computing.
- Assess the security of virtual systems.
- Evaluate the security issues related to multi-tenancy.
- Appraise compliance issues that arise from cloud computing.

COURSE OUTCOME: The student would be able:

CO 1. To know the working of the cloud.
CO 2. To solve cloud migration problems.
CO 3. To use effective and efficient encryption techniques in solving various problems.
CO 4. To analyze risk management.
CO 5. To use appropriate algorithmic strategy for better efficiency

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Introduction	6
2	Visualization and Vulnerabilities	7
3	Risk Management	5
4	Encryption	6
5	Managing IDS	5

Detailed Syllabus

Unit 1: What is cloud, Services provided by cloud: Software as a Service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Desktop as a Service (DaaS) and VDI etc. How Cloud Computing Works, Advantages & Disadvantages, Applications for Businesses Cloud Service Providers, Brief overview of major Cloud Service providers – Amazon AWS, Google App Engine, Microsoft, Vmware. How Companies are using Cloud Computing Cloud Computing Risks and Issues.

Unit 2: Why is cloud security hard? Visualization and multi-tenancy Risk assessment for cloud migration Patch and configuration management Change management. Visualization System & Vulnerabilities- Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, and Network and visualization security.

Unit 3: Risk management, auditing the cloud, remote, on site, cloud audit a6, Assessments for the cloud, penetration testing the cloud, internal assessments.

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Unit 4: Encryption types and availability, key management and encryption architectures, data/information life cycle, retention, disposal, classification. IAM architecture and relevance to the cloud, authentication and authorization standards, account management and provisioning.

Unit 5: Incident detection for different cloud models, Managing Intrusion Detection System/Intrusion Prevention System (IDS/IPS) and alerting.

Text/Reference Books

1. Cloud Computing: Concepts, Technology & Architecture by Thomas ErlPublished May 2013.
2. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, &IaaS) by Michael J. Kavis Published January 2014.
3. Cloud Computing Protected: Security Assessment Handbook by John Rhoton Published January 2013.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	—	—
CO-2	1	—	—
CO-3	2	—	—
CO-4	2	—	—
CO-5	1	—	—

Semester III **MCA (CTIS)**

MCACT 303: STORAGE AND DATA CENTER LAB

0L + 0T + 4P + 2C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To impart the basic concepts of Storage systems and Datacenter environment.
- To understand concepts about RAID techniques.
- To understanding about taking backup and restoring the data with the help of Business Continuity and Disaster Recovery concepts and tools.
- To understand about Data Center Consolidation and Clustering.

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

CO 6. Analyze Storage devices and technologies.
CO 7. Summarize the advantages and functionality of NAS and SAN.
CO 8. Appreciate knowledge on Backups and Disaster Recovery.
CO 9. Describe Data Center Consolidation and its phases.
CO 10. Appreciate knowledge on design and analysis of Cluster Architecture.

List of Experiments:

1. Configuring the Directly Attached Disks for Basic and Dynamic Disks
2. Creating and configuring the disk partitions and volumes for the disk in Windows/Linux System
3. Creating and Configuring the RAID 0, 1 and RAID5 in windows server 2012 R2
4. Configuring the Network Share using Windows Server 2012 R2
5. Configuring the File Server in Windows Server 2012 R2
6. Configuring NFS in Linux Server
7. Configuring the iSCSI in Windows Server 2012 R2
8. Configuring FCOE in Windows Server 2012 R2
9. Creating a System Backup and Restoring in Windows Server and Linux System
10. Creating and Restoring the Snapshot for Virtual Machines in Hyper-V
11. Installing and configuring the NLB in Windows Server 2012 R2
12. Installing and configuring Failover Clustering in Windows Server 2012 R2

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

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Semester III **MCA (CTIS)**

MCACT 304: CLOUD SECURITY LAB

0L + 0T + 4P + 2C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Students are able to:-

- Understand the fundamentals of cloud computing.
- Compare modern security concepts as they are applied to cloud computing.
- Assess the security of virtual systems.
- Evaluate the security issues related to multi-tenancy.
- Appraise compliance issues that arise from cloud computing.

COURSE OUTCOME: The student would be able:

CO 6. To know the working of the cloud.
CO 7. To solve cloud migration problems.
CO 8. To use effective and efficient encryption techniques in solving various problems.
CO 9. To analyze risk management.
CO 10. To use appropriate algorithmic strategy for better efficiency

List of Experiments

1. Introduction to Amazon Cloud Front
2. Introduction to AWS Key Management Service
3. Introduction to Amazon Dynamo DB
4. Introduction to Amazon API Gateway
5. Introduction to Amazon Redshift
6. Introduction to Amazon Aurora
7. Introduction to Amazon Machine Learning
8. Introduction to AWS Lambda
9. Introduction to AWS Internet-of-Things (IoT)
10. Introduction to AWS Device Farm
11. Introduction to Amazon Kinesis Firehose
12. Introduction to Amazon Route 53

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

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COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

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Semester III **MCA (CTIS)**

MCA 301: SEMINAR

0L+0T+4P+2C **MM:100**

COURSE OBJECTIVE: This will enable them to gain confidence in facing the placement interviews

COURSE OUTCOME:

The student should be able to:

CO 1: select one technical topic
CO 2: prepare synopsis
CO 3: present the seminar progress
CO 4: give a final presentation
CO 5: use various teaching aids such as overhead projectors, power point presentation and demonstrative models

Procedure:

The students are to select one technical topic related its branch for Seminar. The student is to submit the synopsis for assessment and approval. Progress for preparation of the seminar topic would be continuously assessed from time to time. Two periods per week are to be allotted and students are expected to present the seminar Progress. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain the attendance.Students have to give a final presentation for 15 minutes on his topic. Students are encouraged to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	3
CO3	-	-	1
CO4	2	-	-
CO5	1	-	-

MCA 302: PROJECT PHASE - I

0L+0T+0P+4C **MM: 100**

COURSE OVERVIEW AND OBJECTIVES: The objective of Project Work is to enable the student to take up investigative study in the broad field of Computer Science & Engineering, either fully theoretical/practical or involving both theoretical and practical work

COURSE OUTCOME:

The student should be able to:

CO 1: Survey and study of published literature on the assigned topic
CO 2: Working out a preliminary Approach to the Problem relating to the assigned topic
CO 3: Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/ Feasibility
CO 4: Preparing a written report on the Study conducted
CO 5: Oral Presentation

The assignment to normally include:

CO 1. Survey and study of published literature on the assigned topic;
CO 2. Working out a preliminary Approach to the Problem relating to the assigned topic; Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/ Feasibility;
CO 3. Preparing a Written Report on the Study conducted for presentation to the Department;
CO 4. Final Seminar, as oral Presentation before a Departmental Committee.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	3
CO3	-	-	1
CO4	2	-	-
CO5	1	-	-

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PROGRAM ELECTIVE III

Semester III **MCA (CTIS)**

MCACT 305: PRINCIPLES OF VIRTUALIZATION

3L+ 0T+0 P+3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To understand the virtualization and Cloud Technology

COURSE OUTCOME: After completion of this course students should be able to:-

CO 1.Understand basic concepts of Virtualization.

CO 2.Understand Virtualization technologies: Hypervisor, emulation, and application VM; Platform virtualization, storage virtualization, and network virtualization etc.

CO 3.Create, manage, migrate and troubleshoot virtual machines, templates, clones, alarms, configure virtual switches, configure virtual storages, examine the features and functions of different storage protocols, such as FC, FCoE, iSCSI, NFS.

CO 4.Understand the VMware vSphere features such as load balancing, migration

CO 5.Understand CPU scheduling, CPU Optimization, network optimization, storage optimization, configuration of distributed switch in virtualized Environment.

OUTLINE OF THE COURSE

Detailed Syllabus

Unit No.	Title of the unit	Time required for the Unit
1.	Introduction	9
2.	Components of vSphere 6.0Management	9
3.	Features of vSphere and NSX	8
4.	VSphere Solutions to Data Center Challenges and vSphere Security	8
5.	Resource optimization and resource management	8

Unit 1: Introduction

Introduction to Virtualization - Types of virtualization - Difference between cloud and virtualization - Physical infrastructure and virtual infrastructure - Virtualization approaches - Partitioning - Hosting - Isolation - Hardware independence - Virtual machine - Hypervisor - Types of hypervisor - Virtual machine manager - Types of hypervisor - Introduction to datacenter virtualization Esxi - Difference between Esxi and Esx - Versions of Esxi - Installation and configuration of Esxi 6.0 - vSphere 6.0

Unit 2: Components of vSphere 6.0

Components of VMware vSphere - vSphere 6.0: Overview and Architecture - Topology of vSphere 6.0 Data Center - vSphere 6.0 Configuration MaximumsvCenter Server - vCenter Server Features - Certificate Management - Alarms and Alerts - Monitoring Features - Template Management - Linked Mode Deployment - Storage Features in vSphere - Shared Storage - Storage Protocols - Datastores - Virtual SAN - Virtual Volumes.

Unit 3: Features of vSphere and NSX

vSphere Resource Management Features - vMotion - Distributed Resource Scheduler (DRS) - - Distributed Power Management (DPM) - Storage vMotion - Storage DRS - Storage I/O Control - Network I/O Control - vSphere Availability Features - vSphere Data Protection - High Availability - Fault Tolerance - vSphere Replication - Introduction to NSX

Unit 4: VSphere Solutions to Data Center Challenges and vSphere Security

Challenges - Availability Challenges - Scalability Challenges - Management Challenges - Optimization Challenges - Application Upgrade Challenges - Cloud Challenges - Security - Describe the features and benefits of VMware Platform Services Controller - Configure ESXi host access and authorization - Secure ESXi - vCenter Server - and virtual machines - Upgrade ESXi and vCenter Server instances

Unit 5: Resource optimization and resource management

Network Optimization - Configure and manage vSphere distributed switches - Migrate virtual machines from standard switches to distributed switches - Explain distributed switch features such as port mirroring - LACP - QoS tagging - and NetFlow - CPU Optimization - Storage Optimization - Diagnose storage access problems.

Text / References Book:

1. Virtualization Essentials Paperback, Matthew Portnoy, Wiley
2. VMware Cookbook, Troy - Shroff/O'Reilly, Wiley
3. Mastering VMware vSphere 5.5 (SYBEX), Scott Lowe, Nick Marshall, Forbes Guthrie, Matt Liebowitz , Josh Atwell, 2014, Wiley

CO-PO Mapping

COs and Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

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Semester III **MCA (CTIS)**

MCACT 306: CLOUD MIGRATION

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand the cloud migration principles

COURSE OUTCOME

The student would be able to:

- Describe characteristics of cloud
- Describe security perspectives
- Describe conceptual services
- Describe schedulers
- Explain current trends

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	6
2	Cloud computing technology	7
3	Working with cloud- infrastructure as a service	6
4	Using cloud services	7
5	Case studies	8

Detailed Syllabus

Unit 1: INTRODUCTION - Shift from distributed computing to cloud computing; principles and characteristics of cloud computing- IaaS, PaaS, SaaS; service oriented computing and cloud environment

Unit 2: CLOUD COMPUTING TECHNOLOGY - Client systems, Networks, server systems and security from services perspectives; Accessing the cloud with platforms and applications; cloud storage

Unit 3: WORKING WITH CLOUD- INFRASTRUCTURE AS A SERVICE – conceptual model and working Platform as a Service – conceptual model and functionalities Software as a Service – conceptual model and working Technologies and Trends in Service provisioning with clouds

Unit 4: USING CLOUD SERVICES - Cloud collaborative applications and services – technology, applications and case studies with calendars, schedulers and event management; cloud applications in project management.

Unit 5: CASE STUDIES - Microsoft Azure, Google App Engine and Open source clouds- Open-Nebula and Eucalyptus , Current trends and research

Text / Reference Books:

1. Anthony T.Velte, Toby J.Velte and Robert E, Cloud Computing – A Practical Approach, TMH , 2010
2. Michael Miller, Cloud Computing – Web based Applications, Pearson Publishing, 2011

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	-	-	-	-	3	-	-
CO2	-	-	-	2	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	-
CO4	-	1	-	-	3	-	-	-	-	-	-	-
CO5	3	-	-	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	1	-
CO2	1	2	-
CO3	-	3	-
CO4	2	2	-
CO5	-	3	1

Semester III **MCA (CTIS)**

MCACT 307: LINUX ADMINISTRATION

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES:

- RHEL is a high performing operating system that. RHEL 6 is the sixth generation of the long term and predictable operating platform.

COURSE OUTCOME: After completion of this course students should be able to:-

CO 1. Attain skills required to manage and administer systems and servers using Linux Operating System.
CO 2. Gain knowledge about Red hat Enterprise Linux 6(RHEL 6).
CO 3. Learn basic commands in Linux and get knowledge about File system.
CO 4. Learn basic server configuration in Linux servers for example, HTTP server, mail server, samba server, ntp server etc.
CO 5. Appear for RED HAT Certification exam in Linux Administration after the completion of this course.

OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit
1.	Introduction to Linux	10
2.	Package, User and group Management 6.0	9
3.	Configuring local storage and filesystem	7
4.	Managing system and infrastructure services	9
5.	OpenSSH and Linux security	7

Detailed Syllabus

Unit 1: Introduction to Linux

Directory structure - System directory - Absolute path and relative path -Creating and removing directory - Changing directory path - Creating - removing - copying

Unit 2: Package, User and group Management

RPM - YUM - Archive - Compress - unpack and uncompress files using tar - star - gzip - and bzip2 - Create - delete - and modify local user accounts - Change passwords for local user accounts - Create - delete - and modify local groups and group memberships - Changing owner and modes

Unit 3: Configuring local storage and filesystem

List - create - delete - and partition type for primary - extended - and logical partitions - Create and remove physical volumes - assign physical volumes to volume groups - Create and delete logical Volumes.

Unit 4: Managing system and infrastructure services

Managing system services - Shutting down - suspending and hibernating the system - Controlling systemd on remote machine - Creating and modifying systemd unit files – DHCP Configuration - HTTP server Configuration - FTP server Configuration - Mail server Configuration - Samba server Configuration - NTP server Configuration - NFS server Configuration

Unit 5: OpenSSH and Linux security

OPENSSH - The SSH Protocol - Configuring OpenSSH and Starting an OpenSSH Server Key-Based Authentication in OpenSSH - OpenSSH Clients - Using the ssh Utility - scp Utility and sftp Utility - Configure firewall settings using system-config-firewall or iptables - Set enforcing and permissive modes for SELinux - List and identify SELinux file and process context

Text / Reference Books:

1. RHCSA/RHCE Red Hat Linux Certification Study Guide Exams EX200 & EX300, Jang Orsaria July 2017, McGraw-Hill Education
2. Red Hat RHCSA/RHCE 7 Cert Guide: Red Hat Enterprise Linux 7 (EX200 and EX300), Sander Van Vugt, 2009, Phi Learning Pvt Ltd

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	–	–	1	–	–	1	1
CO2	3	3	2	2	3	–	–	1	–	–	–	1
CO3	2	3	3	2	2	–	–	–	–	–	1	–
CO4	2	2	3	3	3	–	–	1	–	–	–	1
CO5	2	3	2	2	2	–	–	–	–	–	1	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	–
CO-4	3	2	–
CO-5	3	2	1

Semester III **MCA (CTIS)**

MCACT 308: SECURITY ARCHITECTURE

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To help students relate concepts of information security architecture

COURSE OUTCOME: After completion of this course students should be able to:-

CO 1. Relate concepts of system security
CO 2. Justify the need for securing internet in mitigating important vulnerabilities.
CO 3. Get the basic knowledge of mobile platforms
CO 4. Acquire the knowledge about the supply chain security
CO 5. Acquire the knowledge about critical infrastructure

OUTLINE OF THE COURSE

Unit	Title of the unit	Time required for the Unit
1.	Software and System Security	8
2.	Network Security & Web Security	9
3.	Security in Mobile Platforms	8
4.	Introduction to Hardware Security, Supply Chain Security	9
5.	Issues in Critical Infrastructure and SCADA Security	8

Detailed Syllabus

Unit 1: Software and System Security

Control hijacking attacks – buffer overflow, integer overflow, bypassing browser memory protection, Sandboxing and Isolation, Tools and techniques for writing robust application software, Security vulnerability detection tools, and techniques – program analysis (static, concolic and dynamic analysis), Privilege, access control, and Operating System Security, Exploitation techniques, and Fuzzing

Unit 2: Network Security & Web Security

Security Issues in TCP/IP – TCP, DNS, Routing (Topics such as basic problems of security in TCP/IP, IPsec, BGP Security, DNS Cache poisoning etc), Network Defense tools – Firewalls, Intrusion Detection, Filtering, DNSSec, NSec3, Distributed Firewalls, Intrusion Detection tools, Threat Models, Denial of Service Attacks, DOS-proof network architecture, Security architecture of World Wide Web, Security Architecture of Web Servers, and Web Clients, Web Application Security – Cross Site Scripting Attacks, Cross Site Request Forgery, SQL Injection Attacks, Content Security Policies (CSP) in web, Session Management and User Authentication, Session Integrity, Https, SSL/TLS, Threat Modeling, Attack Surfaces, and other comprehensive approaches to network design for security

Unit 3: Security in Mobile Platforms

Android vs. ioS security model, threat models, information tracking, rootkits, Threats in mobile applications, analyzer for mobile apps to discover security vulnerabilities, Viruses, spywares, and keyloggers and malware detection

Unit 4: Introduction to Hardware Security, Supply Chain Security

Threats of Hardware Trojans and Supply Chain Security, Side Channel Analysis based Threats, and attacks

Unit 5: Issues in Critical Infrastructure and SCADA Security

Security issues in SCADA, IP Convergence Cyber Physical System Security threats, Threat models in SCADA and various protection approaches, Machine learning and SCADA Security

Text/Reference books:

1. Cryptography security architecture: design and verification by Peter Gutmann
2. Security, Design, and Architecture for Broadband and Wireless Network Technologies" by Chilamkurti
3. Security Architecture: Design, Deployment and Applications (RSA Press)" by Christopher King and Curtis Dalton
4. Android Security Internals – An In–Depth Guide to Android's Security Architecture" by Nikolay Elenkov
5. Security Architecture Design Process for Health Information Exchanges (HIEs)" by nis

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

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PROGRAM ELECTIVE IV

Semester III **MCA (CTIS)**

MCACT 309: DATABASE SECURITY

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To help students relate concepts of information security with databases
- To make it possible for students to learn how important principles of Security are implemented in securing the database

COURSE OUTCOME: After completion of this course students should be able to:-

CO 1. Relate concepts of information security with databases.
CO 2. Justify the need for securing database in mitigating important vulnerabilities.
CO 3. Get the basic knowledge of NoSQL database
CO 4. Acquire the knowledge about the encryption and permission used in SQL server 2012.
CO 5. Acquire the knowledge about the security and auditing in SQL server 2012

OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required (Hours)
1.	Concepts of Database Security Management System	8
2.	Concepts of NoSQL	9
3.	Encryption and Permissions in SQL Server 2012	8
4.	Security of SQL Server 2012	9
5.	SQL Server Auditing	8

Detailed Syllabus

Unit 1: Concepts of Database Security Management System

Database security concept, Importance of data, Levels of data security, Authorization in databases, Issues in database security, Concept of Least Privilege in User ID for databases. Perimeter security, firewalls, intrusion detection, and intrusion prevention

Unit 2: Concepts of NoSQL

No SQL databases introduction, Differences from classical DBMS concepts with NoSQL, Advantages of NoSQL like Elastic Scaling, Big Data, Goodbye DBAs', Economics/Cost, Flexible Data models. Non/ partial applicability of ACID (Atomicity, Consistency, Isolation, Durability), BASE Properties, CAP theorem, comparison to traditional RDBMS databases. Horizontal scalability, Benefits of NoSQL Databases compared to traditional Databases, Concept of UnSQL or Unstructured Query Language, Concept of Key Value & Tuple Store Databases, Concept of Graph Databases, Concept of Multimodel Databases

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Unit 3: Encryption and Permissions in SQL Server 2012

Understanding permissions, Creating and using database roles, using schemas for security, configuring cross-database security, Code and Data Encryption- Using service and database master keys, creating and using symmetric and asymmetric keys, creating and storing hash values, Authenticating stored procedure by signature

Unit 4: Security of SQL Server 2012

User authorization, authentication and security, protecting data using permissions, roles, schemas, SQL firewall, web application firewall, securing dynamic SQL from injections, protecting SQL server from DoS and injection attacks

Unit 5: SQL Server Auditing

Auditing – Using the profiler to audit SQL server access, using DML trigger for auditing data modification, Using DDL triggers for auditing structure modification, configuring SQL server auditing, auditing and tracing user configurable events, policy based management, system centre advisor to analyze instances

Text/Reference Books:

1. Database security, Silvana Castano, 2nd Edition, Addison-Wesley Professsional
2. Microsoft SQL server 2012 Security Cookbook, Rudi Bruchez, 1st Edition PACKT publishing
3. Handbook of database security: Applications and Trends, Michael Gerts, Sushil jajodia, 1st, Springer
4. Network Security: A begineers Guide, Eric Maiwald, 3rd McGraw Hill

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	–	1	3	–	–	–	–	–	–	–
CO2	2	–	3	2	1	–	–	–	–	–	–	–
CO3	2	1	–	1	3	–	–	–	–	–	–	–
CO4	1	1	–	1	2	–	–	–	–	–	–	–
CO5	1	2	–	3	2	–	–	–	–	–	–	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	–
CO-3	2	2	–
CO-4	2	3	2
CO-5	3	3	–

Semester III **MCA (CTIS)**

MCACT 310: SERVER SECURITY

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To help students relate concepts of server security

COURSE OUTCOME: After completion of this course students should be able to:-

CO 1. Database security, with a focus on MySQL
CO 2. Using OpenLDAP for authentication
CO 3. An introduction to email encryption
CO 4. The Cyrus IMAP service, a popular mail delivery agent
CO 5. The vsftpd FTP server

OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Security Basics	8
2.	Threats and Risk Assessment	9
3.	Physical Access	8
4.	Logging	9
5.	Auditing and Detection	8

Detailed Syllabus

Unit 1: Security Basics- Principles of Information Security

Unit 2: Threats and Risk Assessment -Authentication: Proof of identity, Authorization: Limiting System Access and Controlling Using Behavior

Unit 3: Physical Access-Restricting Access to Software; Restricting Software Access to Resources

Unit 4: Logging-Controlling Access to Data

Unit 5: Auditing and Detection-Auditing, Monitoring and Assessment

Text/Reference books:

1. Title: Linux Server Security, Second Edition Author(s): Michael D. Bauer Release date: January 2005 Publisher(s): O'Reilly Media, Inc. ISBN: 9780596006709
2. Security, Design, and Architecture for Broadband and Wireless Network Technologies" by Chilamkurti
3. Security Architecture: Design, Deployment and Applications (RSA Press)" by Christopher King and Curtis Dalton
4. Security Architecture Design Process for Health Information Exchanges (HIEs)" by nis

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

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Semester III **MCA (CTIS)**

MCACT 311: IOT SECURITY

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

This course is designed to have students become acquainted with IoT security. Students will be able to understand or master IoT security related to hardware, system and networking.

COURSE OUTCOME: After completion of this course students should be able to:-

CO 1. Understand IoT general models and security challenges.
CO 2. Recognize IoT security and vulnerability threats.
CO 3. Understand different IoT protocols and their security measures.
CO 4. Interpret how to secure an IoT environment
CO 5. Interpret differentiate IoT types of attack.

OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required (Hours)
1.	IOT-SECURITY OVERVIEW	8
2.	IOT- SECURITY &VULNERABILITY	9
3.	SECURED PROTOCOLS FOR IOT	8
4.	SECURING INTERNET OF THINGS ENVIRONMENT	9
5.	IOT ATTCAKS -CASE STUDY	8

Detailed Syllabus

Unit 1: IOT-SECURITY OVERVIEW

IoT Reference Model- Introduction -Functional View, IoT Security Challenges-Hardware Security Risks - Hardcoded/Default Passwords -Resource Constrained Computations -Legacy Assets Connections - Devices Physical Security, Software Security Risks -Software Vulnerabilities -Data Interception - Identification of Endpoints -Tamper Detection, Lack of Industrial Standards

Unit 2: IOT- SECURITY &VULNERABILITY ISSUES

IoT Security Requirements -Data Confidentiality -Data Encryption -Data Authentication -Secured Access Control –IoT-Vulnerabilities – Secret-Key, Authentication/Authorization for Smart Devices - Constrained System Resources -Device Heterogeneity -Fixed Firmware.IoT Attacks -Side-channel Attacks -Reconnaissance -Spoofing -Sniffing -Neighbour -Discovery -Rogue Devices-Man-in-Middle

Unit 3: SECURED PROTOCOLS FOR IOT

Infrastructure-IPv6 -LowPAN , Identification-Electronic Product Code -uCode, Transport-Bluetooth - LPWAN, Data -MQTT -CoAP, Multi-layer Frameworks-Alljoyn,-IoTivity

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Unit 4: SECURING INTERNET OF THINGS ENVIRONMENT

IoT Hardware -Test Device Range-Latency and Capacity -Manufacturability Test -Secure from Physical Attacks, IoT Software -Trusted IoT Application Platforms, -Secure Firmware Updating -Network Enforced Policy -Secure Analytics Visibility and Control

Unit 5: IOT ATTCAKS -CASE STUDY

MIRAI Botnet Attack -Iran's Nuclear FacilityStuxnet Attack -TeslaCryptojacking Attack -The TRENDnet WebcamAttack -The JeepSUV Attack -The Owlet Wi-Fi Baby Heart Monitor Vulnerabilities -St.Jude_Hackable Cardiac Devices

Text/Reference Books:

1. B. Rusell and D. Van Duren, "Practical Internet of Things Security," Packt Publishing, 2016.
2. Johnson Jr, C. Richard, William A. Sethares, and Andrew G. Klein, "Software receiver design: build your own digital communication system in five easy steps," Cambridge University Press, 2011.
3. A. Narayanan et al., "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction," Princeton University Press, 2016.
4. A. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies," O'Reilly, 2014.
5. T. Alpcan and T. Basar, "Network Security: A Decision and Game-theoretic Approach," Cambridge University Press, 2011.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

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Semester III **MCA (CTIS)**

MCACT 312: WEB SECURITY

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To help students understand foundational concepts of WEB security
- To facilitate students to gain knowledge on how network infrastructure and connectivity can be secured.

COURSE OUTCOME: After completion of this course students should be able to:-

CO 1. Describe Security Attacks, Security Services, and Security Mechanisms. Understand various cryptographic techniques. Implement Chinese Remainder Theorem etc for Security mechanisms.

CO 2. Describe DES. Describe IDEA algorithm.

CO 3. Describe RSA algorithms, Diffie hellman key exchange algorithm.

CO 4. Describe SHA Algorithm, MACs.

CO 5. Explain X.509 Authentication Service and PGP and S/MIME email security techniques.

OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	10
2.	User Identity and Access	8
3.	System and Server Security	8
4.	Internet Security	8
5.	Risk Assessment and Cyber Laws	8

Detailed Syllabus

Unit 1: Introduction:

Security Definition, Why Security, Security and its need, Current Trends and Statistics, Basic Terminology, The CIA of Security the Relation: Security functionality.

Unit 2: User Identity and Access Management:

User identity and Access Management: Authentication, Account Authorization, Validation, Access Control and Privilege management, Hashing and Cryptography- Encryption and Decryption.

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Unit 3: System and Server Security:

System Security, Desktop & Server Security, Firewalls, Password cracking Techniques, Key-logger, viruses and worms, Malwares & Spy wares, Windows Registry

Unit 4: Internet Security:

Internet Security: LAN Security, Email Security, Hacking attacks, preventive measures

Unit 5: Risk Assessment and Cyber Laws:

Vulnerability Assessment, Penetration Testing, Risk Assessment, Threat, Vulnerability, Cyber Laws – Indian Context

Textbooks/Reference Books:

1. Mark Stamp's Information Security: Principles and Practice (WIND),Deven N. Shah,Latest Edition, Wiley
2. Information Security Risk Analysis,Thomas R. Peltier,3rd,Auerbach
3. Information Security: The Complete Reference,Mark Rhodes-Ousley,2nd,McGraw Hill Education
4. Cyber Security, Nina Godbole, Sunit Belapure, Latest Wiley

CO-PO Mapping

COs and Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	–	1	3	–	–	–	–	–	–	–
CO2	2	–	3	2	1	–	–	–	–	–	–	–
CO3	2	1	–	1	3	–	–	–	–	–	–	–
CO4	1	1	–	1	2	–	–	–	–	–	–	–
CO5	1	2	–	3	2	–	–	–	–	–	–	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	–
CO-3	2	2	–
CO-4	2	3	2
CO-5	3	3	–

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PROGRAM ELECTIVE V

Semester III **MCA (CTIS)**

MCACT 313: IT GOVERNANCE & RISK MANAGEMENT

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: The primary objective of this course is to understand the concepts of governance, risk management and compliance (GRC)

COURSE OUTCOME: After completion of this course students should be able to:-

CO 1. Identify high-risk areas and compliance in your organization and Apply Risk-based Approach

CO 2. The role of the compliance officer and his team

CO 3. Develop and implement a governance, risk management and compliance strategic plan

CO 4. Understand, define, and enhance organizational culture as it relates to performance, risk, and compliance

CO 5. Implement governance, risk management and compliance processes that are effective and efficient using a risk-based audit approach

OUTLINE OF THE COURSE

Unit	Title of the unit	Time required for the Unit (Hours)
1.	Governance, Risk & Compliance GRC–Definitions	8
2.	Information Security Governance	9
3.	Information Security Management Practices	10
4.	Case Study Analysis	8
5.	Compliance–Technology and security	7

Detailed Syllabus

Unit1: Governance, Risk & Compliance GRC–Definitions

Governance, Risk, Compliance, Risk Threshold, Risk Modeling, Risk Appetite, Governance Standards, Best Practices for IT Governance–ITIL - ISO/IEC 27001 - Control Objectives of Information and Related Technology (COBIT) – The Information Security Management Maturity Model - Capability Maturity Model – latest standards and compliance technologies.

Unit 2: Information Security Governance

Effective Information Security Governance - Importance of Information Security Governance - Outcomes of Information Security Governance - Strategic alignment – Risk Management - Performance Measurement - Information System Strategy - Strategic Planning - Steering Committee- Policies and Procedures

Unit 3: Information Security Management Practices

Personnel Management - Financial Management–Quality Management - Information Security Management - Performance Optimization - Roles and Responsibilities - Auditing IT Governance Structure - Evaluation Criteria & Benchmark - Assessment Tools.

Unit 4: Case Study Analysis

Risk Management framework–COSO - The Internal environment - Objective Setting -Event Identification - Risk assessment - Risk Response - Control activities - Information & communication–Monitoring–NIST - Risk Assessment - Risk Mitigation - Evaluation & Assessment - Case Study Analysis

Unit 5: Compliance–Introduction-Information Technology and security

Evolution of Information systems -Roles and responsibilities - Audit, Assessment and review - The Role of the Compliance Officer -Information System Audit - Scope of System Audit - Audit Planning - Audit Manual - Audit check lists - Audit Reports - Best Practices for IT compliance and Regulatory Requirements.

Textbooks/Reference Books:

1. Cyber Security Management: A Governance, Risk and Compliance Framework, Peter Trim, Yang-Im Lee,2nd Edition

2. Introduction to Information Security: A Strategic-Based Approach, Timothy Shimeall and Jonathan Spring,Latest Edition,Syngress

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	-	-	-	-	3	-	-
CO2	-	-	-	2	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	-
CO4	-	1	-	-	3	-	-	-	-	-	-	-
CO5	3	-	-	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	1	-
CO2	1	2	-
CO3	-	3	-
CO4	2	2	-
CO5	-	3	1

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Semester III **MCA (CTIS)**

MCACT 314: CYBER FORENSICS

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand and document the process of cyber forensics.

COURSE OUTCOME:

Students will be able to:

CO 1. Understand tradeoffs and differences between various forensic tools.
CO 2. To describe the representation and organization of data and metadata within modern computer systems.
CO 3. Fighting against Macro Threats
CO 4. Create disk images, recover deleted files and extract hidden information.
CO 5. Understand the research in computer forensics.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Computer forensic	5
2	Data Recovery	6
3	Electronic Evidence	7
4	Threats	6
5	Surviellance	7

Detailed Syllabus

Unit 1: COMPUTER FORENSICS: Definition, requirement of cyber forensics in today's IT era, Computer Forensics Fundamentals – Types of Computer Forensics Technology – Types of Vendor and Computer Forensics Services, Cyber Crimes & Cyber Forensics,

Unit 2: DATA RECOVERY: Data Recovery – Evidence Collection and Data Seizure – Duplication and Preservation of Digital Evidence – Computer Image Verification and Authentication, Important software tools for Data Recovery, Network Forensics, Email Header investigation

Unit 3: ELECTRONIC EVIDENCE: Discover of Electronic Evidence, Identification of Data Reconstructing Past Events Networks, Electronic evidence and cyber laws, collecting evidence

Unit 4: THREATS: Fighting against Macro Threats – Information Warfare Arsenal – Tactics of the Military – Tactics of Terrorist and Rogues – Tactics of Private Companies.

Unit 5: SURVEILLANCE: The Future Arsenal Surveillance Tools, Victims and Refugees, Advanced Computer Forensics, Case Studies

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Text/Reference Books:

1. John R. Vacca, "Computer Forensics", Firewall Media, 2004.
2. Chad Steel, "Windows Forensics", Wiley India, 2006.
3. Majid Yar, "Cybercrime and Society", Sage Publications, 2006.
4. Robert M Slade, "Software Forensics", Tata McGraw Hill, 2004

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

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Semester III **MCA (CTIS)**

MCACT 315: CYBER CRIME & IT LAW

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand Cyber Law and its impact

COURSE OUTCOME

The student would be able to:

CO 1: Students should acquire a broad perspective on the social and ethical impacts and implications of information technology.

CO 2: Students should acquire specific knowledge about major issues in several different areas of the field of Computer Ethics.

CO 3: Students should acquire in-depth knowledge of at least one significant ethical issue generated by information technology.

CO 4: Students should develop skills in clarifying and ethically analyzing realistic cases that involve information technology.

CO 5: Students should learn about intellectual property issues in cyber space

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	5
2	Cyber law international perspectives	6
3	Constitutional & human rights issues in cyberspace	6
4	Cyber-crimes & legal framework	7
5	Intellectual property issues in cyber space	7

Detailed Syllabus

Unit 1: Introduction- Computers and its Impact in Society, Overview of Computer and Web Technology, Statistics of digital world, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level, Indian IT act 2000, Indian IT act 2008 amendment, important amendment in IT act 2008

Unit 2: Cyber Law International Perspectives- UN & International Telecommunication Union (ITU) Initiatives, Council of Europe: Budapest Convention on Cybercrimes, Asia-Pacific Economic Cooperation (APEC) , Organization for Economic Co-operation and Development (OECD),World Bank, Commonwealth of Nations

Unit 3: 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 4: Cyber Crimes & Legal Framework- Definition, Cyber Crimes against Individuals, Institution and State, Hacking & cracking, Digital Forgery ,Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud, Cyber terrorism, Cyber Defamation, Different offences under IT Act, 2000, Cyber laws and law enforcement

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Unit 5: Intellectual Property Issues In Cyber Space- Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues, domain squatting

Text/Reference Books:

1. Computer Law, Chris Reed & John Angel, OUP, New York, (2007).
2. Cyber Laws, Justice Yatindra Singh, Universal Law Publishing Co, New Delhi, (2012)
3. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi, (2004)
4. Cyber Law, Jonthan Rosenoer, Springer, New York, (1997).
5. Information Technology Act, 2000, S. R. Bhansali, , University Book House Pvt. Ltd., Jaipur (2003).

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	-	-	-	-	-	-	-
CO2	-	-	1	-	-	-	-	-	1	-	-	-
CO3	-	-	-	-	2	-	1	-	-	1	-	-
CO4	-	1	-	-	-	-	-	-	-	-	-	2
CO5	-	-	-	-	-	-	-	-	-	-	2	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	3	-
CO3	-	1	-
CO4	-	1	-
CO5	-	2	2

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Semester III **MCA (CTIS)**

MCACT 316: BIO INFORMATICS

3L + 0T + 0P + 3C **MM 100**

COURSE OBJECTIVE: To develop the ability to design, predict, analyze and compare the protein structures as well as predict the function of target proteins.

COURSE OUTCOME:
The student will be able to:

CO 1. Describe the contents and properties of the most important bioinformatics databases.
CO 2. Analyze and discuss the results of sequence-based searches in light of molecular biological knowledge.
CO 3. Explain the principle for, and execute pairwise sequence alignment by dynamic programming.
CO 4. Illustrate the major steps in pairwise and multiple sequence alignment.
CO 5. Perform text- and sequence-based searches.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Evolution and inheritance	6
2	Concept of cell-cycle and its regulation	5
3	Concepts of transciptome	6
4	Databases	7
5	Computational tools	5

Detailed Syllabus:

Unit 1: Evolution and inheritance. Concept of gene, genetic material and genome. Chemistry of nucleic acids - structure and chemical composition of DNA and RNA.

Unit 2: Concept of cell-cycle and its regulation. Replication of genome, molecular basis of genome evolution. Molecular biology of gene functions (transciption and translation.

Unit 3: Concepts of transciptome, proteome and metabolome. Genomics (genome projects, concepts of structural and functional genomics).

Unit 4: Databases, DNA sequence analysis, protein sequence analysis. Introduction to Neurobiology, Signal Transduction.

Unit 5: Computational tools and techniques for Bioinformatics.

Text Book:

1. Phillip Compeau, Pavel Pevzner, Bioinformatics Algorithms: an Active Learning Approach
2. Neil C. Jones, Pavel Pevzner, Introduction to Bioinformatics Algorithms, ANE Books, 1st Edition edition (1 December 2009)

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Books/References:

1. Molecular Cell Biology by Daid Baltimar
2. Aurther M. Lesk, Introduction to Bioinformatics, Oxford University Press, 4th edition (2014)

3. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bioinformatics Krane and Raymer, DORLING KINDERSLEY (RS); First edition (2003)
4. David Mount : Bioinformatics: Sequence and Genome Analysis, CBS; 2 edition (2005)

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	—	—
CO-2	1	—	—
CO-3	2	—	—
CO-4	2	—	—
CO-5	1	—	—

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TEACHING AND EXAMINATION SCHEME FOR MCA

(Specialization in Cloud Technology and Information Security)

SEMESTER-IV

Course code	Course type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCA 401	PSIT	Project Phase – II/Industry Internship	-	-	-	16	16
		Total	-	-	-	**16**	**16**

L*-Lecture*, T*-Tutorial, P*-Practical

Semester IV **MCA (CTIS)**

MCA 401: PROJECT PHASE II/INDUSTRY INTERNSHIP

0L+0T+0P+16C **MM:100**

COURSE OVERVIEW AND OBEJCTIVES: To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The practical training aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

COURSE OUTCOME:

The student will be able to:

CO 1: develop the work practice
CO 2: solve real life problems related to industry
CO 3: better insight in the practical aspects of the industry
CO 4: facilitate the transition from the thorough theoretical education
CO 5: acquaintance with the culture of companies

Details:

The purpose of practical training is not only to get acquainted with the culture of companies, but also to realize something of importance for the company visited. By working in a group within the company, it is expected that the trainee gets a better insight in the practical aspects of the industry. This is intended to facilitate the transition from the thorough theoretical education, dispensed at our University, into an industrial professional career.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	3
CO3	-	-	1
CO4	2	-	-
CO5	1	-	-

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TEACHING AND EXAMINATION SCHEME FOR

Master of Computer Application

(Specialization in Artificial Intelligence)

SEMESTER II

Course code	Course Type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCA 201	PCC	Java Programming	3	1	-	4	4
MCA 202	PCC	Design and Analysis of Algorithms	3	1	-	4	4
MCA 203	PCC	Database Management System	3	-	-	3	3
MCA 204	PCC	Computer Networks	3	-	-	3	3
MCA*	PEC	Program Elective I	3	-	-	3	3
MCA*	PEC	Program Elective II	3	-	-	3	3
MCA 205	PCC	Java Programming Lab	-	-	4	4	2
MCA 206	PCC	Design and Analysis of Algorithms Lab	-	-	4	4	2
MCA 207	PCC	Database Management System Lab	-	-	4	4	2
TOTAL			**18**	**2**	**12**	**32**	**26**

L*-Lecture*, T*-Tutorial, P*-Practical

Course Code	Program Elective I
MCAAI 201	Introduction to Data Science
MCAAI 202	Internet of Things
MCAAI 203	Machine Learning
MCAAI 204	Natural Language Processing

Course Code	Program Elective II
MCAAI 205	Data Mining & Warehousing
MCAAI 206	Robotic Operating Systems
MCAAI 207	Knowledge Engineering & Expert Systems
MCAAI 208	Computer Vision

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Semester II **MCA (AI)**

MCA 201: JAVA PROGRAMMING

3L+1T+0P+4C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand JAVA programming constructs

COURSE OUTCOME

The student would be able to:

CO 1: Introduction part of Java Programming.
CO 2: Be competent with writing computer programs to implement given simple programs.
CO 3: Describe Packages and Interfaces.
CO 4: Describe Exception Handling and How we can handle it.
CO 5: Be familiar with reading and programming for applet.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Java	6
2	Control statements	6
3	Objects and classes	7
4	String handling	6
5	Concurrency	8

Detailed Syllabus

Unit 1: Java - Introduction to Object Orientated Programming, Abstraction, Object Oriented Programming Principles, Features of JAVA, Introduction to Java byte code, Java Virtual machine.
PROGRAM ELEMENTS: Primitive data types, variables, assignment, arithmetic, short circuit logical operators, Arithmetic operators, bit wise operators, relational operators, Boolean logic operators, the assignment operators, operator precedence, Decision and control statements, arrays.

Unit 2: Control Statements - Java's Selection Statements, if statement, switch statement, Iteration Statements, while, do-while, for, for-each, Nested Loops, Jump Statements, Using break, Using continue, return.

Unit 3: Objects And Classes - Objects, constructors, returning and passing objects as parameter, Nested and inner classes, Single and Multilevel Inheritance, Extended classes, Access Control, usage of super, Overloading and overriding methods, Abstract classes, Using final with inheritance.
PACKAGE AND INTERFACES: Defining package, concept of CLASSPATH, access modifiers, importing package, Defining and implementing interfaces.

Unit 4: String Handling - String constructors, special string operations, character extraction, searching and comparing strings string Buffer class.
Exception Handling: Exception handling fundamentals, Exception types, uncaught exceptions, try, catch and multiple catch statements. Usage of throw, throws and finally .FILE HANDLING: I/O streams, File I/O.

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Unit 5: Concurrency - Processes and Threads, Thread Objects, Defining and Starting a Thread, Pausing Execution with Sleep, Interrupts, Joins, Synchronization. APPLET: Applet Fundamentals, using paint method and drawing polygons.

Text/Reference Books:

1. Herbert Schildt: JAVA 2 - The Complete Reference, TMH, Delhi
2. Deitel: How to Program JAVA, PHI
3. U.K. Chakraborty and D.G. Dastidar: Software and Systems – An Introduction, Wheeler Publishing, Delhi.
4. Joseph O'Neil and Herb Schildt: Teach Yourself JAVA, TMH, Delhi.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	2	3	-	1	-	-
CO2	-	1	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

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Semester II **MCA (AI)**

MCA 202 DESIGN & ANALYSIS OF ALGORITHMS

3L+1T+0P+4C **MM :100**

COURSE OVERVIEW AND OBJECTIVES: Understand the various algorithms and its applications

COURSE OUTCOME

The student would be able to:

CO 1: Understand asymptotic notations to analyze the performance of algorithms.

CO 2: Identify the differences in design techniques and apply to solve optimization problems.

CO 3: Solve pattern matching problems, by choosing the appropriate algorithm design technique for their solution and justify their selection.

CO 4: Understand Randomized algorithms and network flow problem.

CO 5: Analyze deterministic and nondeterministic algorithms to solve complex problems.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Background	5
2	Dynamic programming	6
3	Pattern matching algorithms	6
4	Randomized algorithms	7
5	Problem classes np, np-hard and np-complete	7

Detailed Syllabus

Unit 1: Background: Algorithm Complexity and Order Notations and Sorting Methods.
Divide And Conquer Method: Binary Search, Merge Sort, Quick sort and strassen's matrix multiplication algorithms.
Greedy Method: Knapsack Problem, Job Sequencing, Optimal Merge Patterns and Minimal Spanning Trees.

Unit 2: Dynamic Programming: Matrix Chain Multiplication. Longest Common Subsequence and 0/1 Knapsack Problem
Branch and Bound: Traveling Salesman Problem and Lower Bound Theory. Backtracking Algorithms and queens problem

Unit 3: Pattern Matching Algorithms - Naïve and Rabin Karp string matching algorithms, KMP Matcher and Boyer Moore Algorithms.
Assignment Problems: Formulation of Assignment and Quadratic Assignment Problem.

Unit 4: Randomized Algorithms - Las Vegas algorithms, Monte Carlo algorithms, randomized algorithm for Min-Cut, randomized algorithm for 2-SAT. Problem definition of Multi commodity flow, Flow shop scheduling and Network capacity assignment problems.

Unit 5: Problem Classes NP, NP-Hard and NP-Complete - Definitions of P, NP-Hard and NP-Complete Problems. Decision Problems, Cook's Theorem, Proving NP-Complete Problems - Satisfiability problem and Vertex Cover Problem. Approximation Algorithms for Vertex Cover and Set Cover Problem

Text/Reference Books:

1. Coreman, Rivest, Lisserson, : "Algorithm", PHI.
2. Basse, "Computer Algorithms: Introduction to Design & Analysis", Addision Wesley.
3. Horowitz & Sahani, "Fundamental of Computer Algorithm", Galgotia.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	2	-	-	-	-
CO5	-	-	-	-	-	-	-	-	1	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	1	-
CO3	-	1	-
CO4	-	2	-
CO5	-	2	-

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Semester II **MCA (AI)**

MCA 203: DATABASE MANAGEMENT SYSTEM

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Understanding and implementation of data storage and organization and its applications

COURSE OUTCOME

The student would be able to:

CO 1: Describe the fundamental elements of database management systems.

CO 2: Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL

CO 3: understand Query Language.

CO 4: evaluate database anomalies and normalization

CO 5: understand transaction concepts, data mining and warehousing

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	5
2	Relational model	6
3	Relational database design	6
4	Internet databases	7
5	Advanced topics	8

Detailed Syllabus

Unit 1: Introduction - Database Systems versus File Systems, View of Data, Data Models, database languages, Database Users and Administrators. Transaction Management, Decision Support Systems, Components of a Database management System, Distributed Processing and Client- Server Architecture, Entity-Relationship Model – Basic Concepts, Constraints, Keys, Design Issues, E-R Diagrams

Unit 2: Relational Model - Structures of relational databases, Integrity Constraints, Logical database Design, Tables, Views, and Data Dictionary. Relational Algebra, Relational Calculus. SQL – Basic Structures, Query Handling, Embedded SQL, Open Database Connectivity (ODBC), Java Database Connectivity (JDBC), Triggers, Security and Authorization. Query By Example (QBE), User Interfaces and Tools, Forms and Graphical User Interfaces. Report Generators. Overview of Relational Query Optimization

Unit 3: Relational Database Design - Functional Dependencies, Multi-valued Dependencies, Normal Forms, Decomposition into Normalized Relations, Physical Database Design – File Structures. Object-Relational Databases – Nested Relations, Complex Data types, Object-Relational Features in SQL:1999.

Unit 4: Internet Databases - World Wide Web, Client Side Scripting and Applets, Web Servers and Sessions, Services, Server Side Scripting. XML – Structure of XML Data, XML Document Schema, XQuery, Storage of XML Data, XML Applications.

Unit 5: Advanced Topics - Fundamental Concepts of Transaction Management, Concurrency Control, Recovery Systems, Data Analysis and OLAP. Introduction to Data Mining, Data Farming, Data Warehousing, Spatial and Geographic Databases, Temporal databases and Multimedia Databases.

Text / Reference Books:

1. Date C J, " An Introduction to Database Systems", Addision Wesley
2. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill
3. Elmasri, Navathe, "Fudamentals of Database Systems", Addision Wesley
4. Leon & Leon,"Database Management Systems", Vikas Publishing House
5. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications
6. Majumdar & Bhattacharya, "Database Management System", TMH

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	1	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-
CO5	-	1	2	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	-	1	-
CO3	-	3	-
CO4	-	2	-
CO5	1	-	-

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Semester II **MCA (AI)**

MCA 204: COMPUTER NETWORKS

3L + 0T + 0P + 3C **MM 100**

COURSE OBJECTIVE: To understand the basics of networking and its underlying principles. This course enables learners to understand computer networking concepts, how they work, operate, communicate with ports and Protocols. Standards and models associated with networking technology and their troubleshooting mechanisms.

COURSE OUTCOME:

After completion of the course the student will be able to:

CO1: Explain the types of Network and its architecture

CO2: Identify the function of each layer in OSI and TCP/IP Models

CO3: Discuss the functionality of networking devices

CO4: Demonstrate the IPv4 and IPv6 addressing types

CO5: Practice Network troubleshooting.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Networking Fundamentals	5
2	Basics of Network, Transport and Application Layers	6
3	Basics of Network Devices	5
4	WAN Technology	6
5	Troubleshooting Network	6

Detailed syllabus:

Unit 1: Networking Fundamentals Basics of Network & Networking, Advantages of Networking, Types of Networks, Types of Network Architecture, Workgroup Vs. Domain. Network Topologies, Types of Topologies, Logical and physical topologies, selecting the Right Topology, Types of Transmission Media, Communication Modes, Wiring Standards and Cabling, media connectors, Introduction of OSI model, Functions of the seven layers, Introduction of TCP/IP Model, Comparison between OSI model & TCP/IP model.

Unit 2: Basics of Network Devices Network Devices- NIC- functions of NIC, installing NIC, Hub, Switch, Bridge, Router, Gateways, And Other Networking Devices, Repeater, CSU/DSU, Modem, Ethernet standards, Ethernet Components, Point-to-Point Protocol, Address Resolution Protocol, Message format, transactions, Benefits of Wireless Technology, Types of Wireless Networks, Wireless network Components, wireless LAN standards, wireless security Protocols.

Unit 3: Basics of Network, Transport and Application Layers Network Layer: Internet Protocol (IP), IP standards, versions, functions, The IPv4 and IPv6 Datagram Format, IPv4 addressing, IPv4 Subnetting, CIDR and VLSM, IPv6 Addressing, , Internet Control Message Protocol , Internet Group Management Protocol ,Introduction to Routing and Switching concepts, Transport Layer: Transmission Control Protocol(TCP), User Datagram Protocol (UDP), Overview of Ports & Sockets, Application Layer Protocols

Unit 4: WAN Technology Introduction to WAN, WAN Switching techniques, connecting to the Internet, Satellite-Based Services, Cellular Technologies, Technologies used for Connecting LANs, Remote Access Connections and technologies, Authentication and Authorization, Tunnelling and Encryption Protocols, Security Appliances and Security Threats.

Unit 5: Troubleshooting Network Trouble Shooting Networks: Command-Line Interface Tools, Network and Internet Troubleshooting, Troubleshooting Model, identify the affected area, probable cause, implement a solution, test the result, recognize the potential effects of the solution, document the solution, Using Network Utilities: ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat, Hardware trouble shooting tools, system monitoring tools.

Text/ Reference Books:

1. Data Communication And Networking(Sie), Forouzan, TMH
2. Computer Network, Tanenbaum, Pearson
3. CCNA Cisco Certified Network Associate: Study Guide (With CD) 7th Edition (Paperback), Wiley India, 2011
4. CCENT/CCNA ICND1 640-822 Official Cert Guide 3 Edition (Paperback), Pearson, 2013
5. Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback), Pearson, 2008
6. CCNA Exploration Course Booklet: Routing Protocols and Concepts, Version 4.0 (Paperback), Pearson, 2010

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	2	3	-	1	-	-
CO2	-	1	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

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Semester II

MCA (AI)

MCA 205: JAVA PROGRAMMING LAB

0L+0T+4P+2C

MM:100

COURSE OVERVIEW AND OBJECTIVES: Understand JAVA programming constructs

COURSE OUTCOME

The student would be able to:

CO1: write classes and functions programming
CO2: Understand and implement interfaces
CO3: Implementation of packages
CO4: Implementation of exception handling
CO5: Understand JDBC

Programs in JAVA:

1. Creation of classes and use of different types of functions.
2. Count the number of objects created for a class using static member function.
3. Write programs on interfaces and packages.
4. Write programs using function overloading.
5. Programs using inheritance
6. Programs using IO streams.
7. Programs using files.
8. Write a program using exception handling mechanism.
9. Programs using AWT
10. Programs on swing.
11. Programs using JDBC

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	2	3	-	1	-	-
CO2	-	1	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

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Semester II **MCA (CTIS)**

MCA 206: DESIGN AND ANALYSIS OF ALGORITHMS LAB

0L+0T+4P+2C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand the various algorithms and its applications

COURSE OUTCOME

The student would be able to:

CO 1: Understand asymptotic notations to analyze the performance of algorithms.

CO 2: Identify the differences in design techniques and apply to solve optimization problems.

CO 3: Solve pattern matching problems, by choosing the appropriate algorithm design technique for their solution and justify their selection.

CO 4: Understand Randomized algorithms and network flow problem.

CO 5: Analyze deterministic and nondeterministic algorithms to solve complex problems.

LIST OF EXPERIMENTS:

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n.
2. Sort a given set of elements using merge sort method and determine the time required to sort the elements. Repeat the experiment for different of values of n.
3. Write a program to obtain the topological ordering of vertices in a given digraph.
4. Implement travelling salesman problem.
5. Implement the knapsack problem (0/1).
6. Print all the nodes reachable from a given starting node in a digraph using BFS method.
7. Check whether a given graph is connected or not using DFS method.
8. Write a program to implement binary search using divide and conquer technique
9. Write a program to implement insertion sort using decrease and conquer technique
10. Find minimum cost spanning tree of a given undirected path using a Prim's algorithm.
11. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	2	-	-	-	-
CO5	-	-	-	-	-	-	-	-	1	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	1	-
CO3	-	1	-
CO4	-	2	-
CO5	-	2	-

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Semester II **MCA (AI)**

MCA 207: DATABASE MANAGEMENT SYSTEM LAB

0L+0T+4P+2C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understanding and implementation of data storage and organization and its applications

COURSE OUTCOME

The student would be able to:

CO 1: write programs to store student details
CO 2: perform Database creation/ deletion, table creation/ deletion.
CO 3: Understanding Query Execution
CO 4: Able to check Validity of Query
CO 5: Designing of a database management system

List of Experiments:

Student can use MySql (preferred open source DBMS) or any other Commercial DBMS tool (MS-Access / ORACLE) at backend and C++ (preferred) Php/JAVA at front end.

1.
   a. Write a C++ program to store students records (roll no, name, father name) of a class using file handling.(Using C++ and File handling).
   b. Re-write program 1, using any DBMS and any compatible language.(C++/MySQL)
2.
   a. Write a program to take a string as input from user. Create a database of same name. Now ask user to input two more string, create two tables of these names in above database.
   b. Write a program, which ask user to enter database name and table name to delete. If database exist and table exist then delete that table.
3. Write a program, which ask user to enter a valid SQL query and display the result of that query.
4. Write a program in C++ to parse the user entered query and check the validity of query. (Only SELECT query with WHERE clause)
5. Create a database db1, having two tables t1 (id, name, age) and t2 (id, subject, marks).
   a. Write a query to display name and age of given id (id should be asked as input).
   b. Write a query to display average age of all students.
   c. Write a query to display mark-sheet of any student (whose id is given as input).
   d. Display list of all students sorted by the total marks in all subjects.
6. Design a Loan Approval and Repayment System to handle Customer's Application for Loan and handle loan repayments by depositing installments and reducing balances.
7. Design a Video Library Management System for managing issue and return of Video tapes/CD and manage customer's queries.

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CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	1	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-
CO5	-	1	2	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	-	1	-
CO3	-	3	-
CO4	-	2	-
CO5	1	-	-

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PROGRAM ELECTIVE I

Semester II **MCA (AI)**

MCAAI 201: INTRODUCTION TO DATA SCIENCE

3L+0T+0P+3C **MM: 100**

COURSE OVERVIEW AND OBJECTIVES: Knowledge and expertise for data scientist

COURSE OUTCOME:

Students will be able to:

CO 1: Understand how data is collected.
CO 2: To describe the key concepts in data science
CO 3: Analyse data set
CO 4: evaluate data visualizations
CO 5: understand management scripts

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	5
2	Data Collection	6
3	Data Analysis	7
4	Data Visualization	6
5	Applications	7

Detailed Syllabus

Unit 1: Introduction
Introduction, Terminology, data science process, data science toolkit, Types of data

Unit 2: Data Collection
Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources

Unit 3: Data Analysis
Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM,

Unit 4: Data Visualization
Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings

Unit 5: Applications
Applications of Data Science, Technologies for visualization, Bokeh (Python)

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Reference/Text Book:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly.
2. The Art of Data Science by Roger D. Peng and Elizabeth Matsui
3. Practical Statistics for Data Scientists — by Peter Bruce

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	1	-	-

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Semester II | **MCA (AI)**

MCAAI 202: INTERNET OF THINGS

3L + 0T + 0P + 3C | **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Understand the design and functional blocks of machine to machine communication.

COURSE OUTCOME
The student would be able to:
CO 1: To understand the fundamentals of internet of things.
CO 2: To provide knowledge about IoT devices, applications and examples.
CO 3: To acquire skills to program the embedded devices and connecting them to the web and cloud.
CO 4: Program simple actuators and sensors.
CO 5: Build client programs that push sensor readings from a device to a web service.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required (Hours)
1	Introduction to IoT	6
2	Concept of Data, Information, Knowledge and Wisdom	5
3	Network and Communication Aspects	7
4	Design and Development of IoT Systems	6
5	Domain Specific Applications of IoT and its Challenges	7

Detailed Syllabus:

Unit 1: Introduction to IoT: Defining IoT, Characteristics, Physical Design, Logical Design, Functional Blocks, Communication Models and APIs, Computer Networks, Internet of Everything (IOE), Distributed Computing, Industrial Automation, Understanding IT and OT Convergence, Evolution of IoT, Machine to Machine Communication, Difference between IoT and M2M, Software Define Network.

Unit 2: Concept of Data, Information, Knowledge and Wisdom: Knowledge Discovery Process, DIKW Pyramid and Relevance with IoT, Microcontrollers, Cost, Performance and Power Consumption, Commercial Microcontroller Based Development Boards, Selection Criteria and Trade-Offs.

Unit 3: Network and Communication Aspects: Wireless Medium Access Issues, Mac Protocol Survey, Survey-Routing Protocols, Sensor Deployment Basics & Node Discovery, Data, Aggregation & Dissemination. Sensor Node Architecture, WSN/M2M Communication Technologies, Bluetooth, Zigbee, Wifi. Cellular Communication and LpWAN (Lora and LoraWAN Technologies), Topologies, Applications.

Unit 4: Design and Development of IoT Systems: IoT Reference Architectures, Standardization Initiatives and Interoperability Issues. IoT Design Considerations, Architecture (Devices, Networks and Cloud), Network, Communication Technologies and Protocols, Smart Asset Management: Connectivity, Visibility, Analytics and Alerts.

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Unit 5: Domain Specific Applications of IoT and its Challenges: Home Automation, Industry Applications, Surveillance Applications, Other IoT Applications, Design Issues and Challenges in IoT, Security, Development, Deployment, Usage. Security Standards, Vulnerabilities, Attack Surfaces, Hardware and Software Solutions, Open Source Initiatives.

Text/ Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle. (2014). From Machine-To-Machine to the Internet of Things: Introduction to a New Age of Intelligence. Academic Press.
2. Francis Dacosta. (2013). Rethinking the Internet of Things: A Scalable Approach to Connecting Everything. Apress.
3. Vijay Madisetti and ArshdeepBahga. (2014). Internet of Things: A Hands-On-Approach. Orient Blackswan.
4. Adrian Mcewen, HakinCassimally. (2015). Designing the Internet of Things. Wiley.
5. Peter Waher. (2018). Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3. Packt
6. Rolf H. Weber, Romana Weber. (2010). Internet of Things: Legal Perspectives. Springer.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	3	-
CO3	-	-	2	-	-	-	-	-	1	3		-
CO4	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	1	-	2	-	1	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	-	-	2
CO3	1	-	2
CO4	-	2	3
CO5	-	-	1

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Semester II **MCA (AI)**

MCAAI 203: MACHINE LEARNING

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: To impart knowledge about the concepts of machine learning. To introduce the fundamental concepts of distributed nature of operating system, network, data and processes.

COURSE OUTCOME: The student would be able:

CO 1. Develop an understanding of what is involved in learning models from data.
CO 2. Understand a wide variety of learning algorithms.
CO 3. Apply principles and algorithms to evaluate models generated from data.
CO 4. Apply the algorithms to a real-world problem.
CO 5. Understanding Machine learning in new era of appications

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Introduction	5
2	Different Techniques	8
3	Probability and Classification	5
4	Linear Classifiers	6
5	Ensemble Methods	8

Detailed Syllabus

Unit 1: Introduction to Machine Learning, Problems, data, and tools, Visualization tools, Decision Tree Learning.

Unit 2: Artificial Neural Networks, Bayesian Learning, Deep Learning, Instance-Based Learning, Regression Techniques, Linear regression, SSE, gradient descent, closed form, normal equations, features, Overfitting and complexity, training, validation, test data, Classification problems, decision boundaries, nearest neighbor methods.

Unit 3: Probability and classification, Bayes optimal decisions, Naive Bayes and Gaussian class-conditional distribution.

Unit 4: Linear classifiers: Bayes Rule and Naive Bayes Model, Logistic regression, online gradient descent, Kernel Methods, Radial Basis Function Networks, Support Vector Machines, Genetic Algorithms, Reinforcement Learning,

Unit 5: Ensemble methods: Bagging, random forests, boosting Unsupervised learning: clustering, k-means, hierarchical agglomeration, Latent space methods, PCA, Text representations, naive Bayes and

multinomial models, clustering and latent space models, VC-dimension, structural risk minimization, margin methods and support vector machines (SVM), Machine Learning Applications.

Text/Reference Books

1. Introduction to Machine Learning by Ethem Alpaydin, PHI Learning.
2. Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and Hall/CRC.
3. Pattern Recognition and Machine Learning by Christopher M. Bishop, Springer.
4. Machine Learning by Tom Mitchell, McGraw Hill Education.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	–	2	–	–	–	–	–	–	–	–	–
CO2	–	3	–	–	–	–	–	–	–	–	–	–
CO3	2	1	3	–	–	–	–	–	–	–	–	–
CO4	–	–	–	3	–	–	–	–	–	–	–	–
CO5	2	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

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Semester II **MCA (AI)**

MCAAI 204: NATURAL LANGUAGE PROCESSING

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To learn about the concepts and principles of natural language processing.
- To explore both theoretical and practical issues of natural language processing.
- To develop skills of finding solutions and building software using natural language processing techniques.

COURSE OUTCOME: The student would be able to:

CO 1. Understand the concept of natural language processing.
CO 2. Understand various research issues in natural language processing.
CO 3. Apply various tools and techniques in natural language processing.
CO 4. Understand Information Retrieval
CO 5. Understand Grammar types.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Introduction	7
2	Grammar and NLP stages	7
3	Semantics	6
4	Pragmatics	7
5	NGRAMS	7

Detailed Syllabus

Unit 1: Introduction: Knowledge of Natural Language Processing, Ambiguity, Models and Algorithms, Text representation in computers, encoding schemes, Regular expressions, Finite State Automata, word recognition, lexicon.

Unit 2: Grammar and NLP Stages NLP grammar, POS and POS schemes, Stochastic POS tagging, HMM, Transformation based tagging (TBL), Handling of unknown words, named entities, multi word expressions, lexical analyzer, Parsing, Stemming, Smoothing and Interpolation Named Entity Recognition.

Unit 3: Semantics- Meaning representation, semantic analysis, lexical semantics, WordNet, Word Sense Disambiguation- Sectional restriction, machine learning approaches, and dictionary-based approaches.

Unit 4: Pragmatics: Discourse, Reference Resolution, Reference Phenomena, Syntactic and Semantic Constraints on Coreference, Preferences in Pronoun Interpretation, Text Coherence and Inference Based Resolution Algorithm, Corpora: elements in balanced corpus, Concordance and corpora, characteristics

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of Gold Standard Corpora. TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML, Management of linguistic data with the help of GATE, NLTK.

Unit 5: Parallel Corpus, Comparable corpus, Inter-Annotator Agreement Tests, kappa statistics. Corpus annotation tools. NGRAMS: Counting words in Corpora, N-Gram probabilities, Training and Test sets, Evaluating N-Gram Perplexity. Machine Translation and Performance Metrics Machine Translation issues, MT Evaluation, automatic evaluation BLEU, METEOR, ORANGE, Information Retrieval: Vector space model, term weighting, homonymy, polysemy, synonymy, improving user queries.

Text/Reference Books

1. Speech and Language Processing by Daniel Jurafsky and James H. Martin, Prentice Hall.
2. Language as a Cognitive Process by T. Winograd, Addison-Wesley.
3. Natural Language Understanding by James Allen, the Benjamins/Cummings.
4. Natural language processing: a Paninian perspective by A. Bharati, R. Sangal, and V. Chaitanya, PHI.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	–	1	3	–	–	–	–	–	–	–	–	–
CO2	–	–	2	–	–	–	–	–	–	–	–	–
CO3	2	3	–	–	–	–	–	–	–	–	–	–
CO4	–	–	–	3	–	–	–	–	–	–	–	–
CO5	2	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

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PROGRAM ELECTIVE II

Semester II **MCA (AI)**

MCAAI 205: DATA MINING & WARE HOUSING

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand the concepts of mining data and knowledge discovery

COURSE OUTCOME

The student would be able to:

CO 1: Understand data mining functionalities and concept of interesting patterns
CO 2: Ability to understand Data Preprocessing.
CO 3: Understanding of association rules.
CO 4: Describe Clustering algorithms and Partitioning methods
CO 5: Explain binary classification

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	6
2	Data	7
3	Association and correlation analysis	5
4	Clustering algorithms and cluster analysis	6
5	Classification	6

Detailed Syllabus

Unit 1: Introduction - Basic concepts of data mining, including motivation and definition; different types of data repositories; data mining functionalities; concept of interesting patterns; data mining tasks; current trends, major issues and ethics in data mining

Unit 2: Data - Types of data and data quality; Data Preprocessing: data cleaning, data integration and transformation, data reduction, discretization and concept hierarchy generation; Exploring Data: summary statistics, visualization, multidimensional data analysis

Unit 3: Association And Correlation Analysis - Basic concepts: frequent patterns, association rules - support and confidence; frequent itemset generation - Apriori algorithm, FP-Growth algorithm; Rule generation, Applications of Association rules; Correlation analysis.

Unit 4: Clustering Algorithms and Cluster Analysis - Concept of clustering, measures of similarity, Clustering algorithms: Partitioning methods - k-means and k-medoids, CLARANS, Hierarchical methods - agglomerative and divisive clustering, BIRCH, Density- based methods - Subspace clustering, DBSCAN; Graph-based clustering - MST clustering; Cluster evaluation; Outlier detection and analysis.

Unit 5: Classification: Binary Classification - Basic concepts, Bayes theorem and Naive Bayes classifier, Association based classification, Rule based classifiers, Nearest neighbour classifiers, Decision Trees, Random Forest; Perceptrons; Multi-category classification; Model overfitting, Evaluation of classifier performance - cross validation, ROC curves.
Applications: Text mining, Web data analysis, Recommender systems. Prerequisites: Familiarity with basic Linear Algebra and Probability will be assumed.

Text / Reference Books:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining. Pearson (2005), India. ISBN 978-8131714720
2. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 3rd edition (July 2011). 744 pages. ISBN 978-0123814791
3. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann, 3rd edition (January 2011). 664 pages. ISBN 978-0123748560.
4. T. Hastie, R. Tibshirani and J. H. Friedman, The Elements of Statistical Learning, Data Mining, Inference, and
5. Prediction. Springer, 2nd Edition, 2009. 768 pages. ISBN 978- 0387848570
6. C. M. Bishop, Pattern Recognition and Machine Learning. Springer, 1st edition, 2006. 738 pages. ISBN 978- 0387310732

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	-	-
CO2	-	-	-	3	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	1	-	-	1	-	2	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	2	-
CO5	1	-	-

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Semester II | MCA (AI) | APPROVED

MCAAI 206: ROBOTIC OPERATING SYSTEMS

3L + 0T + 0P + 3C | **MM 100**

COURSE OBJECTIVE: This subject covers various design and service provided in robotics environment

COURSE OUTCOMES:
The student would be able to:

CO 1: Introduction to ROS Topics, Services, Actions and Nodes.
CO 2: Software representation of a Robot using Unified Robot Description Format (URDF)
CO 3: Build a production line application with two industrial robot arms and a mobile robot.
CO 4: Basic knowledge of Object detection, pose estimation.
CO 5: Map creation with GMapping package, autonomously navigate a known map

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	6
2	ROS Design	7
3	ROS Services	5
4	ROS Standards	6
5	Coordinate frames and transforms	7

Detailed Syllabus:

Unit 1: Introduction
Understanding ROS, ROS Environment, Installation and Configuration of ROS Environment, ROS Filesystem, ROS package:create and build.

Unit 2: ROS Design: Graph concepts, Nodes, topic, messages, command line tools: roscore, rosnode, rosrun, rostopic, rqt_plot

Unit 3: ROS services: connections and parameters; system dependencies and roslaunch, debugging, visualizing

Unit 4: ROS Standards: coding style, package layout, naming conventions, common procedures

Unit 5: Coordinate frames and transforms: actions/tasks, message ontology, client libraries: main and experimental

Text/Reference Books:

1. Morgan Quigley, Brian Gerkey, William D. Smart, "Programming Robots with ROS", O'Reilly Media,2015
2. Low K. H., "Industrial Robotics: Programming, Simulation and Applications", I-Tech, 2007.
3. John J. Craig, "Introduction to Robotics Mechanics and Control", 3rd edition, Pearson, 2008.
4. B. Siciliano and K.P. Valavanis, "Control problems in Robotics and Automation", Springer, 1998.

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CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	2	-	-	-	-
CO5	-	-	-	-	-	-	-	-	1	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	1	-
CO3	-	1	-
CO4	-	2	-
CO5	-	2	-

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Semester II **MCA (AI)**

MCAAI 207: KNOWLEDGE ENGINEERING & EXPERT SYSTEMS

3L + 0T + 0P + 3C **MM 100**

COURSE OBJECTIVES To enable the students:

- To get introduced to the basic knowledge representation, problem solving, and learning methods of Artificial Intelligence.
- To solve problems in Artificial Intelligence using Python.
- To familiarize with Fuzzy Logic and knowledge processing in expert systems.

COURSE OUTCOME : The students will be able to :

CO 1. know the fundamental concepts of Artificial Intelligence such as knowledge representation, problem solving, fuzzy set and expert systems
CO 2. Understanding of the principles of knowledge engineering
CO 3. Design and development of an expert system
CO 4. Planning, and management of an expert system
CO 5. Implement search methods using Python.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Problems and Search	5
2	Search Methods	7
3	Knowledge Representation	5
4	Learning	6
5	Expert System	5

Detailed Syllabus

Unit 1: Problems and Search: What is Artificial Intelligence, The AI Problems, Defining the Problem as a State Space Search, Problem Characteristics Searching strategies – Generate and Test, Heuristic Search Techniques- Hill climbing– issues in hill climbing. Python-Introduction to Python- Lists Dictionaries & Tuples in Python- Python implementation of Hill Climbing.

Unit 2: Search Methods - Best First Search - Implementation in Python - OR Graphs, The A * Algorithm, Problem Reduction AND-OR Graphs, The AO* algorithm, Constraint Satisfaction. MINIMAX search procedure, Alpha–Beta pruning.

Unit 3: Knowledge representation - Using Predicate logic - representing facts in logic, functions and predicates, Conversion to clause form, Resolution in propositional logic, Resolution in predicate logic,

Unification. Representing Knowledge Using Rules: Procedural Versus Declarative knowledge, Logic Programming, Forward versus Backward Reasoning.

Unit 4: Learning: What is learning, Rote learning, Learning by Taking Advice, Learning in Problem-solving, Learning from example: induction, Explanation-based learning.
Connectionist Models: Hopfield Networks, Learning in Neural Networks, Applications of Neural Networks, Recurrent Networks. Connectionist AI and Symbolic AI

Unit 5: Expert System –Representing and using Domain Knowledge – Reasoning with knowledge– Expert System Shells –Support for explanation- examples –Knowledge acquisition-examples.

Text Books:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill Publishing Company Ltd., New Delhi, Third Edition, ISBN: 13:978-0-07-008770-5, 2010.
2. Stuart Russell, Peter Norvig, "Artificial Intelligence- A modern approach", Pearson Education Asia, Second Edition, ISBN:81-297-0041-7

References:

1. Akshar Bharati, Vineet Chaitanya, Rajeev Sangal, "Natural Language Processing: A Paninian Perspective", Prentice Hall India Ltd., New Delhi, 1996, ISBN 10: 8120309219
2. Amit Konar, Artificial Intelligence and Soft Computing, CRC Press.
3. Dan W.Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall India Ltd., New Delhi, 2009, ISBN: 81-203-0777-1.
4. Rajendra Akerkar, Introduction to Artificial Intelligence, PHI Learning Pvt. Ltd., 2005, ISBN: 81-203- 2864-7.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	–	1	3	–	–	–	–	–	–	–	–	–
CO2	–	–	2	–	–	–	–	–	–	–	–	–
CO3	2	3	–	–	–	–	–	–	–	–	–	–
CO4	–	–	–	3	–	–	–	–	–	–	–	–
CO5	2	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

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Semester II **MCA (AI)**

MCAAI 208: COMPUTER VISION

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES:

- To study the development of algorithms and techniques
- To analyze and interpret the visible world around us.
- Be familiar with both the theoretical and practical aspects of computing with images.
- To understand the basic concepts of Computer Vision.
- Understand the geometric relationships between 2D images and the 3D world.
- Ability to apply the various concepts of Computer Vision in other application areas.

COURSE OUTCOME:

CO 1. Understand the fundamental problems of computer vision.
CO 2. Implement various techniques and algorithms used in computer vision.
CO 3. Analyze critically the building and integration of computer vision algorithms.
CO 4. Demonstrate awareness of the current key research issues in computer vision.
CO 5. Evaluate critically the building and integration of computer vision algorithms.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Digital Image Formation	5
2	Depth estimation and multi-camera views	6
3	Scale-Space Analysis	6
4	Classification	5
5	Shape from X	6

Detailed Syllabus

Unit 1: Digital Image Formation and low-level processing: State-of-the-art, fundamentals of image formation. Transformation: orthogonal, Euclidean, affine, projective. Fourier transform, convolution and filtering, image enhancement, restoration, histogram processing.

Unit 2: Depth estimation and multi-camera views: perspective, binocular stereopsis: camera and epipolar geometry, homography, rectification, DLT, RANSAC, 3-D reconstruction framework, auto-calibration, apparel. Feature extraction: Edges canny, LOG, DOG. Line detectors (Hough Transform), Corners: Harris and Hessian Affine, orientation histogram, SIFT, SURF, HOG, GLOH.

Unit 3: Scale-Space Analysis: Image pyramids and Gaussian derivative filters, Gabor filters and DWT. Image Segmentation: Region growing, edge-based approaches to segmentation, graph-cut, mean-shift, MRFs, texture segmentation, object detection. Clustering: KMeans, K-Medoids, mixture of Gaussians

Unit 4: Classification: Discriminant function, supervised, unsupervised, semi-supervised. Classifiers: Bayes, KNN, ANN models. Dimensionality Reduction, Motion Analysis: background subtraction and modeling, optical flow, KLT, spatio-temporal analysis, dynamic stereo, motion parameter estimation.

Unit 5: Shape from X: light at surfaces, phong model, reflectance map, Albedo estimation, photometric stereo, use of surface smoothness, constraint, shape from texture, color, motion and edges. Applications: CBIR, CBVR, activity recognition, computational photography, biometrics, stitching and document processing. Recent Trends: 3-D Printing, 3-D sensing, simultaneous location and mapping, GPU, edge-computing, augmented reality, virtual reality cognitive models, fusion and super resolution.

Text/Reference books:

1. Computer Vision: Algorithms and Applications by Richard Szeliski, Springer-Verlag.
2. Computer Vision: A Modern Approach by D. A. Forsyth and J. Ponce, Pearson Education.
3. Multiple View Geometry in Computer Vision by Richard Hartley and Andrew Zisserman, Cambridge University Press.
4. Introduction to Statistical Pattern Recognition by K. Fukunaga, Academic Press, Morgan Kaufmann.
5. Digital Image Processing by R.C. Gonzalez and R.E. Woods, PHI

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	-	1	—
CO-2	-	2	—
CO-3	-	3	—
CO-4	-	1	—
CO-5	-	1	—

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TEACHING AND EXAMINATION SCHEME FOR

Master of Computer Application

(Specialization in Artificial Intelligence)

SEMESTER-III

Course Code	Course Type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCAAI 301	PCC	Deep Learning	3	1	-	4	4
MCAAI 302	PCC	Reinforcement Learning	3	-	-	3	3
MCA*	PEC	Program Elective III	3	-	-	3	3
MCA*	PEC	Program Elective IV	3	-	-	3	3
MCA*	PEC	Program Elective V	3	-	-	3	3
MCAAI 303	PCC	Deep Learning Lab	-	-	4	4	2
MCAAI 304	PCC	Reinforcement Learning Lab	-	-	4	4	2
MCA 301	PSIT	Seminar	-	-	4	4	2
MCA 302	PSIT	Project Phase – I	-	-	-	8	4
		Total	**15**	**1**	**12**	**36**	**26**

Course Code	Program Elective III
MCAAI 305	Pattern Recognition
MCAAI 306	Speech & Biometric Processing
MCAAI 307	Blockchain
MCAAI 308	Management Information System

Course Code	Program Elective IV
MCAAI 309	Prolog Programming
MCAAI 310	Embedded System
MCAAI 311	Artificial Intelligence & Intelligent Agents
MCAAI 312	Distributed Operating Systems

Course Code	Program Elective V
MCAAI 313	Big Data Analytics
MCAAI 314	Semantic Web
MCAAI 315	Business Intelligence
MCAAI 316	Bio Informatics

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Semester III **MCA (AI)**

MCAAI 301: DEEP LEARNING

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Students are able to:-

- To build the foundation of deep learning.
- To understand how to build the neural network.
- To enable the students to develop successful machine learning projects.

COURSE OUTCOME: The student would be able:

CO 1. Learn the fundamental principles of deep learning.
CO 2. Identify the deep learning algorithms for various types of learning tasks in various domains.
CO 3. Implement deep learning algorithms and solve real-world problems.
CO 4. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
CO 5. To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Introduction	6
2	Convolutional Neural Network	6
3	Application of Deep Learning to Computer vision	5
4	Application of Deep Learning to NLP	6
5	Opinion Mining using Recurrent Neural Networks	6

Detailed Syllabus

Unit 1: Introduction: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout.

Unit 2: Convolutional Neural Networks: Architectures, convolution / pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Autoencoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models

Unit 3: Dynamic memory networks, Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention models for computer vision tasks.

Unit 4: Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity, Analogy reasoning: Named Entity Recognition,

Unit 5: Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs, Applications of Dynamic Memory Networks in NLP, Factoid Question Answering, similar question detection, Dialogue topic tracking, Neural Summarization

Text/Reference Books

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models by D. Koller, and N. Friedman, MIT Press.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

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Semester III **MCA (AI)**

MCAAI 302: REINFORCEMENT LEARNING

3L + 0T + 0P + 3C **MM 100**

COURSE OUTCOME: By the end of this course, students should be able to do the following:

CO 1. Learn how to define RL tasks and the core principals behind the RL, including policies, value functions.
CO 2. Implement in code common algorithms following code standards and libraries used in RL
CO 3. Understand and work with tabular methods to solve classical control problems
CO 4. Understand and work with approximate solutions (deep Q network-based algorithms)
CO 5. Learn the policy gradient methods from vanilla to more complex cases

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Reinforcement Learning Primitives	6
2	Markov Decision Process and Dynamic Programming	6
3	Monte Carlo Methods and Temporal Difference Learning	5
4	Deep Reinforcement Learning	6
5	Multi Agent in RL	6

Detailed Syllabus

Unit 1: Reinforcement Learning Primitives: Introduction and Basics of RL, Defining RL Framework, Probability Basics: Probability Axioms, Random Variables, Probability Mass Function, Probability Density Function, Cumulative Distribution Function and Expectation. Introduction to Agents, Intelligent Agents – Problem Solving – Searching, Logical Agents.

Unit 2: Markov Decision Process and Dynamic Programming: Markov Property, Markov Chains, Markov Reward Process (MRP), Bellman Equations for MRP, Dynamic Programming: Polices (Evaluation, Improvement, Iteration, Value Iteration), Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming

Unit 3: Monte Carlo Methods and Temporal Difference Learning: Monte Carlo: Prediction, Estimation of Action Values, Control and Control without Exploring Starts, Off-Policy Control, Temporal Difference Prediction:TD(0), SARSA: OnPolicy TD control, Q-Learning: Off-Policy TD control, Games, Afterstates, and Other Special Cases.

Unit 4: Deep Reinforcement Learning Deep Q-Networks, Double Deep-Q Networks(DQN, DDQN, Dueling DQN, Prioritized Experience Replay). Policy Optimization in RL Introduction to Policy-based Methods, Vanilla Policy Gradient, REINFORCE Algorithm and Stochastic Policy Search.

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AsynchronousActor-Critic and Asynchronous Advantage ActorCritic (A2C, A3C), Advanced Policy Gradient (PPO, TRPO, DDPG).

Unit 5: Multi Agent in RL Multi-Agent Learning, Meta-learning, Partially Observable Markov Decision Process, Ethics in RL, Applying RL for Real-World Problems

Text Book(s):

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An Introduction", Second Edition, MIT Press, 2019.
2. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach.", Pearson Education Limited, 2016. Michael Wooldridge, "An Introduction to Multi Agent Systems", John Wiley, 2002.

Reference Books:

1. Ian Goodfellow, YoshuaBengio, and Aaron Courville. "Deep learning." MIT press, 2017.
2. Marco Wiering, Martijn van Otterlo(Ed),"Reinforcement Learning, State-of-the-Art, Adaptation, Learning, and Optimization book series, ALO, volume 12, Springer, 2012.
3. Keng, Wah Loon, Graesser, Laura, "Foundations of Deep Reinforcement Learning: Theory and Practice in Python", Addison Wesley Data & Analytics Series, 2020.
4. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018. RagavVenkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

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Semester III **MCA (AI)**

MCAAI 303: DEEP LEARNING LAB

0L + 0T + 4P + 2C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Students are able to:-

- To build the foundation of deep learning.
- To understand how to build the neural network.
- To enable the students to develop successful machine learning projects.

COURSE OUTCOME: The student would be able:

CO 1. Learn the fundamental principles of deep learning.
CO 2. Identify the deep learning algorithms for various types of learning tasks in various domains.
CO 3. Implement deep learning algorithms and solve real-world problems.
CO 4. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
CO 5. To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.

List of Experiments

1. Installation and working on various tools viz. Hadoop, Python, Spark, NoSQL, ANACONDA, Tensorflow, Keras, AWS, etc.
2. Understanding key technology foundations required for Big Data.
3. Learning Hadoop systems for implementing Big Data problems.
4. Development of real-time data based applications using Hadoop.
5. Development of applications using pytorch library.
6. Knowledge extraction from given data.
7. Use of machine learning and deep learning techniques for solving image related problems.
8. Comparative evaluation of deep learning models.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

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CO-PSO Mapping

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COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

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Semester III **MCA (AI)**

MCAAI 304: REINFORCEMENT LEARNING LAB

0L + 0T + 4P + 2C **MM 100**

Course objectives: This course will enable students to

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course outcomes: The students should be able to:

CO 1. Learn how to define RL tasks and the core principals behind the RL, including policies, value functions.
CO 2. Implement in code common algorithms following code standards and libraries used in RL
CO 3. Understand and work with tabular methods to solve classical control problems
CO 4. Understand and work with approximate solutions (deep Q network-based algorithms)
CO 5. Learn the policy gradient methods from vanilla to more complex cases

List of Experiments

1. Implement and demonstrate the FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge toclassify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	—	—
CO-2	1	—	—
CO-3	2	—	—
CO-4	2	—	—
CO-5	1	—	—

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Semester III **MCA (AI)**

MCA 301: SEMINAR

0L+0T+4P+2C **MM:100**

COURSE OBJECTIVE: This will enable them to gain confidence in facing the placement interviews

COURSE OUTCOME:
The student should be able to:
CO 1: select one technical topic
CO 2: prepare synopsis
CO 3: present the seminar progress
CO 4: give a final presentation
CO 5: use various teaching aids such as overhead projectors, power point presentation and demonstrative models

Procedure:
The students are to select one technical topic related its branch for Seminar. The student is to submit the synopsis for assessment and approval. Progress for preparation of the seminar topic would be continuously assessed from time to time. Two periods per week are to be allotted and students are expected to present the seminar Progress. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain the attendance.Students have to give a final presentation for 15 minutes on his topic. Students are encouraged to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	3
CO3	-	-	1
CO4	2	-	-
CO5	1	-	-

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Semester III **MCA (AI)**

MCA 302: PROJECT PHASE - I

0L+0T+0P+4C **MM: 100**

COURSE OVERVIEW AND OBJECTIVES: The objective of Project Work is to enable the student to take up investigative study in the broad field of Computer Science & Engineering, either fully theoretical/practical or involving both theoretical and practical work

COURSE OUTCOME:

The student should be able to:

CO 1: Survey and study of published literature on the assigned topic
CO 2: Working out a preliminary Approach to the Problem relating to the assigned topic
CO 3: Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/ Feasibility
CO 4: Preparing a written report on the Study conducted
CO 5: Oral Presentation

The assignment to normally include:

- Survey and study of published literature on the assigned topic;
- Working out a preliminary Approach to the Problem relating to the assigned topic; Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/ Feasibility;
- Preparing a Written Report on the Study conducted for presentation to the Department;
- Final Seminar, as oral Presentation before a Departmental Committee.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	3
CO3	-	-	1
CO4	2	-	-
CO5	1	-	-

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PROGRAM ELECTIVE III

Semester III **MCA (AI)**

MCAAI 305: PATTERN RECOGNITION

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Students are able to:-

- To build the foundation of deep learning.
- To understand how to build the neural network.
- To enable the students to develop successful machine learning projects.

COURSE OUTCOME: The student would be able:

- Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
- Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
- Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
- Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
- Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Introduction to Pattern Recognition	6
2	Nearest Neighbor Based Classifiers	6
3	Hidden Markov Models	5
4	Support Vector Machines	6
5	Clustering	6

Detailed Syllabus

Unit 1: Introduction to Pattern Recognition: Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition,
Pattern Representation: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature, Feature Selection, Evaluation of Classifiers, Evaluation of Clustering

Unit 2: Nearest Neighbour Based Classifiers: Nearest Neighbour Algorithm, Variants of the NN Algorithm, Use of the Nearest Neighbour Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection,
Bayes Classifier: Bayes Theorem, Minimum error rate classifier, Estimation of Probabilities, Comparison with the NNC, Naive Bayes Classifier, Bayesian Belief Network.

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Unit 3: **Hidden Markov Models:** Markov Models for Classification, Hidden Markov Models, Classification Using HMMs, Classification of Test Patterns.
Decision Trees: Introduction, Decision Trees for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Over fitting and Pruning, Example of Decision Tree Induction.

Unit 4: **Support Vector Machines:** Introduction, Linear Discriminant Functions, Learning the Linear Discriminant Function, Neural Networks, SVM for Classification, Linearly Separable Case, Non-linearly Separable Case.
Combination of Classifiers: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers, Evaluation of Classifiers, Evaluation of Clustering

Unit 5: **Clustering:** Clustering and its Importance, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets, An Application to Handwritten Digit Recognition: Description of the Digit Data, Pre-processing of Data, Classification Algorithms, Selection of Representative Patterns.

Text Books:

1. Pattern Recognition an Introduction, V. Susheela Devi M. Narasimha Murty, University Press.
2. Pattern Recognition, Segrios Theodoridis,Konstantinos Koutroumbas, Fourth Edition, Elsevier

Reference Books:

1. Pattern Recognition and Image Analysis, Earl Gose, Richard John Baugh, Steve Jost, PHI 2004.
2. C. M. Bishop, 'Neural Networks for Pattern Recognition', Oxford University Press, Indian Edition, 2003.
3. Pattern Classification, R.O.Duda, P.E.Hart and D.G.Stork, Johy Wiley, 2002

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

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Semester III **MCA (AI)**

MCAAI 306: SPEECH & BIOMETRIC PROCESSING

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Students are able to:-

- To design and development of different algorithms of a biometric system.
- To analyze the data for development of personal identification in real time.

COURSE OUTCOME: A student will learn about biometric matching basics, authentication, identification, and verification approaches for application on real time problems.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit (Hours)
1	Introduction to Biometrics	6
2	Types of Biometrics	6
3	Multimodal Systems	5
4	Biometric Performance hierarchy	6
5	Applications	6

Detailed Syllabus

Unit 1: Introduction to Biometrics: Biometric attributes, Biometric data, System overview, Privacy and its challenges, Biometric matching basics, authentication, identification

Unit 2: Types of Biometrics: Biometric systems based on fingerprint recognition, Iris recognition, Face identification and localization in images, Retina recognition methods, Human identification based on gait, Speech as biometric data

Unit 3: Multimodal Systems: Advantages of multimodal system, Types of multimodal system, Combination techniques: Feature level fusion, score level fusion, decision level fusion. Performance Testing and reporting, Errors in the test set, matching issues

Unit 4: Biometric Performance hierarchy: The statistical basis of biometric system, hypothesis testing, The False Match, False Non-Match and Equal Error Rates, ROC curves, DET curves, Identification - CMC curve, verification, Dealing with uncertainty, Systematic Errors, Sampling Errors, Confidence Interval Interpretation, Computing Confidence Intervals, Parametric Techniques, Non-parametric Bootstrapping, Statistical measures of Biometrics, Comparison of privacy factor in different biometrics technologies, Biometrics for Network Security.

Unit 5: Applications: Iris Recognition, Fingerprint Recognition, Surveillance Systems.

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TEXT BOOK:

1. Ted Dunstone and Neil Yager, *Biometric System and Data Analysis: Design, Evaluation, and data Mining*, Springer
2. R. M. Bolle, J. H. Connell, S. Pankanti, N. K. Ratha, and A. W. Senior, *Guide to Biometrics*, Springer

REFERENCES:

1. A.K. Jain, R. Bolle and S. Pankanti (Eds.), *: Personal Identification in Networked society*, Kluwer Academic Publishers
2. John Vacca, *Biometrics Technologies and verification Systems*, Elsevier Inc. , 2007

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	—	—
CO-2	1	—	—
CO-3	2	—	—
CO-4	2	—	—
CO-5	1	—	—

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Semester III **MCA (AI)**

MCAAI 307: BLOCKCHAIN

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Understand the building blocks of crypto currency

COURSE OUTCOME
The student would be able to:
CO 1: Describe Cryptography
CO 2: Describe Encryption
CO 3: Describe Crypto currency basics
CO 4: Describe SHA Algorithms
CO 5: Explain Hyper-Ledger

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction to Cryptography	6
2	Conventional Encryption	7
3	Key management	6
4	Introduction to Block chain and Crypto-currency Basics	7
5	Working of Block chain and Hyper Ledger	8

Detailed Syllabus:

Unit 1: Introduction to Cryptography: Introduction to Advanced Cryptography and Cryptanalysis, Classical Encryption Techniques – Substitution Techniques, Transposition Techniques, And Permutation Method. Advanced Encryption Techniques and Security Issues – RC4, One-time Pad, RSA, DES, Triple DES, AES and Diffie Hellman, Case study

Unit 2: Conventional Encryption :Confidentiality using conventional encryption – Placement of Encryption, Traffic Confidentiality, Key Distribution and Random Number Generation.

Unit 3: Key management – Generating Keys, Nonlinear Keyspaces, Transferring Keys, Verifying Keys, Using Keys, Updating Keys, Storing keys, Backup keys, Compromised Keys, Lifetime of Keys, Destroying Keys and Public-Key Management, Case study.

Unit 4: Introduction to Blockchain and Crypto-currency Basics :What is Blockchain, Blockchain Technology and Mechanisms, Challenges, Centralized Servers and Trusted Third Party, Shift from gold standard to flat currency to Hash cash/Digital, Trust less System, Transactions and Blocks, Digital Signatures,Discussion on Bitcoin and Ethereum, Significance, Security, The Bitcoin Mining Network, Mining Developments, Decentralization and Hard Forks, Ethereum Eco-System

Unit 5: Working of Blockchain and Hyper Ledger
Technology behind Blockchain-Consensus Building, Proof of Work, Byzantine Generals, Distributed Consensus, Cryptography, Hashing, Data Integrity, Public vs. Private Key Cryptography, Merkle Trees. Crypto-currency and Mining, Proof of Work vs. Stake, Business Model, What is Hyper Ledger, Distributed Ledger Technology, Hyper Ledger Fabric and Composer, Assets, Chaincode and Ledger/Transactions, Permission Network, Member Services, Nodes and Channels, Development Machine Specifications and IDE.

Text/ Reference Books:

1. Imran Bashir. (2018). Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts explained, Import.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder. (2016). Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press.
3. Alex Tapscott and Don Tapscott. (2016). Blockchain Revolution: How the Technology behind Bitcoin Is Changing Money, Business, and the World, Portfolio.
4. Dr. Gavin Wood. (2014) Ethereum: A Secure Decentralized Transaction Ledger. Yellow Paper.
5. Chris Dannen. (2017). Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming for Beginners. Apress..

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	3
CO3	-	-	1
CO4	2	-	-
CO5	1	-	-

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Semester III **MCA (AI)**

MCAAI 308: MANAGEMENT INFORMATION SYSTEM

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Understand the managing data and information and decision models

COURSE OUTCOME The student would be able to:
CO1: Managing Information Systems in Organization
CO2: Understand Data and Information
CO3: Decision making and communication
CO4: Learn SCM, CRAM and International Systems
CO5: Managing Social Media

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Managing Information Systems in Organization	6
2	Data and Information	6
3	Decision making and communication	4
4	SCM, CRAM and International Systems	5
5	Managing social media	7

Detailed Syllabus:

Unit 1: Managing Information Systems in Organization: Introduction, Definition, Need of MIS, Managing in the Internet Era, Managing Information Systems in Organization-the IT interaction model, Challenges for the manager-what information to build?-how much to spend on information systems?-what level of capabilities should be created with information systems?-how centralized should the services be?-what security levels are required?-what is technology road map for the organization?

Unit 2: Data and Information: Introduction, data and information- measuring data, information as a resource, information in organizational functions, types of information technology, types of information systems- transaction processing systems-management information systems

Unit 3: Decision making and communication: Introduction, Decision making with MIS-Tactical decisions-operational decisions-strategic decisions, communication in organizations- types of communication- examples of communications in organizations- decision making with communication technology, Decision Support Systems: Introduction, Understanding DSS- MIS and DSS-Decision making-types of decisions, Analytics and Business Intelligence- BI techniques

Unit 4: SCM, CRAM and International Systems: Introduction, Supply Chain Management Systems, Customer Relationships Management Systems, Challenges of Enterprise Systems Implementations-Managing the implementation, International Information Systems-Outsourcing and off-shoring

Unit 5: Managing Social Media: Introduction, Social Dynamics of the Internet, Services of the Internet- Blogs-Social Networks, Technology of the Internet- Twitter-Rating-Tagging/folksonomies, Social issues-Media impact-Collaboration-Emergence of order, Social Networks in the Enterprise Managing IT Function: Introduction, Challenges of Managing the IT function- Modern IT environment-Centralization versus Decentralization-IT security-Technology selection, Vendor Management- vendor selection-vendor contracts and service levels-Ongoing relationship management- vendor retention or termination

Text/ Reference Books:

1. Management Information Systems, Jawadekar, Tata McGraw Hill
2. Management Information Systems, Davis and Olson, Tata McGraw Hill
3. Analysis and Design of Information Systems, Rajaraman, Prentice Hall
4. Decision Support Systems and Intelligent Systems, Turban and Aronson, PearsonEducation Asia
5. Management Information Systems, Schulthesis, Tata McGraw Hill
6. Management Information Systems - Sadagopan, Prentice Hall

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	2	3	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	-	2	-	2	-	-	-	-	-	-	-	-
CO4	-	-	2	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	3	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	1	-
CO3	-	3	-
CO4	-	2	-
CO5	-	1	-

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PROGRAM ELECTIVE IV

Semester III **MCA (AI)**

MCAAI 309: PROLOG PROGRAMMING

3L + 0T + 0P + 3C **MM 100**

COURSE OVERVIEW AND OBJECTIVES: Understand the underlying principles of Prolog Programming

COURSE OUTCOME

The student would be able to:

CO 1: write programs in Prolog using techniques such as accumulators and difference structures;
CO 2: know how to model the backtracking behavior of program execution;
CO 3: appreciate the unique perspective Prolog gives to problem solving and algorithm design;
CO 4: understand how larger programs can be created using the basic programming techniques
CO 5: identify what Problems to Solve Debugging

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	An overview of Prolog	5
2	Working with Lists, Numbers and Operators	6
3	Backtracking, Cuts and Negation	6
4	Logic Foundations of Prolog	5
5	Recursive Programming	7

Detailed Syllabus:

Unit 1: An overview of Prolog

An overview of Prolog, components of a Prolog program, syntax of Prolog, meaning of a Prolog program, Clauses, Programs and Queries

Unit 2: Working with Lists, Numbers and Operators

Notation, Head and Tail, Some Built-in Predicates for List Manipulation, working with numbers: The is-Operator for Arithmetic Evaluation, Predefined Arithmetic Functions and Relations, working with operators: Precedence and Associativity, Declaring Operators with op/3.

Unit 3: Backtracking, Cuts and Negation

Backtracking and Cuts: Backtracking Revisited, Problems with Backtracking, Introducing Cuts, Problems with Cuts, Negation as Failure: The Closed World Assumption, Horn Formulas and Resolution.

Unit 4: Logic Foundations of Prolog

Translation of Prolog Clauses into Formulas, Horn Formulas and Resolution

Unit 5: Recursive Programming

Induction in Mathematics, the Recursion Principle, What Problems to Solve Debugging

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Text Books/Reference Books:

1. PROLOG Programming for Artificial Intelligence Bratko I., Addison-Wesley, Reading, MA, 1986
2. Programming in Prolog , Clocksin W.F. & Mellish C.S., Springer-Verlag, Berlin, 1981, A good introduction to programming in PROLOG
3. Foundations of Logic Programming, Lloyd J.W., Springer-Verlag, Berlin, 1984, Logic programming is a theory behind the PROLOG. You can find introduction to this topic here.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	-	-	-	-	-	-	-
CO2	-	-	1	-	-	-	-	-	1	-	-	-
CO3	-	-	-	-	2	-	1	-	-	1	-	-
CO4	-	1	-	-	-	-	-	-	-	-	-	2
CO5	-	-	-	-	-	-	-	-	-	-	2	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	3	-
CO3	-	1	-
CO4	-	1	-
CO5	-	2	2

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Semester III

MCA (AI)

MCAAI 310: EMBEDDED SYSTEM

3L + 0T + 0P + 3C

MM 100

COURSE OVERVIEW AND OBJECTIVES: Understand the underlying principles of Prolog Programming

COURSE OUTCOME

The student would be able to:

CO 1: write programs in Prolog using techniques such as accumulators and difference structures;
CO 2: know how to model the backtracking behavior of program execution;
CO 3: appreciate the unique perspective Prolog gives to problem solving and algorithm design;
CO 4: understand how larger programs can be created using the basic programming techniques
CO 5: identify what Problems to Solve Debugging

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	5
2	Characteristics and quality attributes of embedded systems	6
3	Programming Embedded Systems	6
4	Embedded hardware	5
5	Peripherals	7

Detailed Syllabus:

Unit 1: Introduction: Embedded Systems and general purpose computer systems, history, classifications, applications and purpose of embedded systems. Core of Embedded Systems: Microprocessors and microcontrollers, RISC and CISC controllers, Big endian and Little endian processors, Application specific ICs, Programmable logic devices, COTS, sensors and actuators, communication interface, embedded firmware, other system components, PCB and passive components.

Unit 2: Characteristics and quality attributes of embedded systems: Characteristics, Operational and nonoperational quality attributes, application specific embedded system - washing machine, domain specific - automotive.

Unit 3: Programming Embedded Systems: Structure of embedded program, infinite loop, compiling, linking and locating, downloading and debugging.

Unit 4: Embedded hardware: Memory map, i/o map, interrupt map, processor family, external peripherals, memory - RAM, ROM, types of RAM and ROM, memory testing, CRC, Flash memory.

Unit 5: Peripherals: Control and Status Registers, Device Driver, Timer Driver-Watchdog Timers, Embedded Operating System, Real-Time Characteristics, Selection Process. Design and Development: Embedded System development environment - IDE, Types of file generated on cross compilation, disassembler / decompiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry.

Text Books:

1. Programming Embedded Systems in C and C++, First Edition January, Michael Barr, O' Reilly Introduction to embedded systems, Shibu K V Tata McGraw-Hill.

References:

2. Embedded Systems, Rajkamal, TataMcGraw-Hill.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	—	—
CO-2	1	—	—
CO-3	2	—	—
CO-4	2	—	—
CO-5	1	—	—

Semester III

MCA (AI)

MCAAI 311: ARTIFICIAL INTELLIGENCE AND INTELLIGENT AGENTS

3L + 0T + 0P + 3C

MM 100

COURSE OVERVIEW AND OBJECTIVES: Understanding of artificial intelligence and its application areas

COURSE OUTCOME

The student would be able to:

CO 1: Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.

CO 2: Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.

CO 3: Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing

CO 4: Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.

CO 5: Formulate and solve problems with uncertain information using Bayesian approaches.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction	6
2	Informed Search Strategies	7
3	Uncertainty	5
4	Learning	6
5	Intelligent Systems	7

Detailed Syllabus:

Unit 1: Introduction - What is intelligence? Foundations of artificial intelligence (AI), History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies.

Unit 2: Informed Search Strategies - Best first search, A* algorithm, heuristic functions, Iterative deepening A*(IDA), small memory A*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning

Unit 3: Uncertainty - Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making- Utility theory, utility functions, Decision- theoretic expert systems.

Unit 4: Learning Forms of Learning, Inductive Learning: - Learning Decision Trees, Statistical learning methods: - Naïve Bayes models, Bayesian network, EM algorithm, HMM, Instance based learning:-nearest neighbour models.

Unit 5 : Intelligent Systems- Expert System- Stages in the Development of an Expert System, Difficulties in Developing Expert System, Application of Expert System, Introduction to Evolutionary Programming, Swarm Intelligent Systems.

Text / Reference Books:

1. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson Education Press, 2001.
2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.
3. George F. Luger, Artificial Intelligence, Pearson Education, 2001.
4. Mils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	2	2	1	-	-	-	-	-	-	-
CO2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	-	-	-	2	-	-	-	-	-	-	-	-
CO4	-	-	1	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	1	-
CO2	-	2	-
CO3	-	2	-
CO4	-	1	-
CO5	-	3	-

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Semester III **MCA (AI)**

MCAAI 312: DISTRIBUTED OPERATING SYSTEMS

3L+0T+0P+3C **MM:100**

COURSE OVERVIEW AND OBJECTIVES: Understand Distributed Systems

COURSE OUTCOME

The student would be able to:

CO 1: Apply knowledge of distributed systems techniques and methodologies.
CO 2: Explain the design and development of distributed systems and distributed systems applications.
CO 3: Use the application of fundamental Computer Science methods and algorithms in the development of distributed systems and distributed systems applications.
CO 4: Discuss the design and testing of a large software system, and to be able to communicate that design to others.
CO 5: Students will examine how existing systems have applied the concepts of distributed systems in designing large systems, and will additionally apply these concepts to develop sample systems.

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Distributed deadlock detection	6
2	Deadlock detection	7
3	Distributed objects and remote invocation	6
4	Transactions and concurrency control	5
5	Distributed algorithms	8

Detailed Syllabus

Unit 1: Distributed Deadlock Detection - system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms. Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem.

Unit 2: Deadlock Detection - system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms. Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem.

Unit 3: Distributed Objects and Remote Invocation - Communication between distributed objects, Remote procedure call, Events and notifications, Java RMI case study.
Security: Overview of security techniques, Cryptographic algorithms, Digital signatures, Cryptography pragmatics, Case studies: Needham Schroeder, Kerberos, SSL & Millicent.

Vivekananda Global University Academic Council Jaipur

Unit 4: Transactions And Concurrency Control - Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control. DISTRIBUTED TRANSACTIONS: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

Unit 5: Distributed Algorithms - Introduction to communication protocols, balanced sliding window protocol, Routing algorithms, Destination based routing, APP problem, Deadlock free Packet switching, Introduction to Wave & traversal algorithms, Election algorithm-CORBA

Text/Reference Books:

4. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Ed.
5. Gerald Tel, "Distributed Algorithms", Cambridge University Press
6. William Stalling, Distributed System, Addision Wesley

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	3
CO3	-	-	1
CO4	2	-	-
CO5	1	-	-

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PROGRAM ELECTIVE V

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Semester III

MCA (AI)

MCAAI 313: BIG DATA ANALYTICS

3L + 0T + 0P + 3C

MM 100

COURSE OVERVIEW AND OBJECTIVES:

- To understand the Big Data Platform and its Use cases.
- Apply analytics on Structured and Unstructured Data.
- Acquire the knowledge and working on Big Data platforms

COURSE OUTCOME: The student would be able:

CO 1. Describe and analyze various Big Data platforms.
CO 2. Develop Big Data Solutions using Hadoop Eco System.
CO 3. Apply Machine Learning Techniques using R.
CO 4. Understand Hadoop File System
CO 5. Understand Big Data and SQ

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction to Big Data	6
2	HDFS (Hadoop Distributed File System)	5
3	Hadoop I/O	6
4	Hadoop Eco System Pig	6
5	Hbase	6

Detailed Syllabus

Unit 1: Introduction to Big Data: Types of Digital Data, Introduction to Big Data, Big Data Analytics, Relational Databases & SQL, Data Cleansing and Preparation, History of Hadoop, Apache Hadoop, Analyzing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, IBM Big Data Strategy, Infosphere Big Insights and Big Sheets.

Unit 2: HDFS (Hadoop Distributed File System): The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives.

Unit 3: Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Map Reduce, Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Unit 4: Hadoop Eco System Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Meta store, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions

Unit 5: Hbase: HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL, Data Analytics with R, Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, collaborative filtering. Big Data Analytics with BigR.

Text/Reference Books

1. Data Science for Business by F. Provost and T. Fawcett, O'Reilly Media.
2. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics by Bill Franks, John Wiley & Sons.
3. Hadoop: The Definitive Guide by Tom White, O'reily Media.
4. Big Data and Business Analytics by Jay Liebowitz, Auerbach Publications, CRC Press

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

Semester III

MCA (AI)

MCAAI 314: SEMANTIC WEB

3L + 0T + 0P + 3C

MM 100

COURSE OVERVIEW AND OBJECTIVES:

- To understand the concepts of Semantic Web.
- To understand the characteristics of the agents.
- To understand design and implementation of Agents.
- To understand the implementation described in the architecture level.

COURSE OUTCOME: The student would be able:

CO 1. Discuss about basic of semantic web and search engine
CO 2. Explain RDFS and its process
CO 3. Explain various semantic web services and its design
CO 4. Study SWOOGLE
CO 5. Understand SEMANTIC WEB SERVICES

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	INTRODUCTION	6
2	SEMANTIC WEB TECHNOLOGY	5
3	OWL	6
4	SWOOGLE	6
5	SEMANTIC WEB SERVICES	6

Detailed Syllabus

Unit 1: INTRODUCTION

The world of the semantic web-WWW-meta data-Search engine-Search engine for traditional web-Semantic web-Search engine for semantic web-Traditional web to semantic web.

Unit 2: SEMANTIC WEB TECHNOLOGY

RDF-Rules of RDF-Aggregation-Distributed information-RDFS-core elements of RDFSOntology-Taxonomy-Inferencing based on RDF schema

Unit 3: OWL

OWL-Using OWL to define classes-Set operators-Enumerations-Define propertiesontology matching-Three faces of OWL-Validate OWL.

Unit 4: SWOOGLE

Swoogle-FOAF-Semantic markup-Issues-prototype system-Design of Semantic web search engine-Discovery and indexation-prototype system-case study.

Unit 5: SEMANTIC WEB SERVICES

Semantic web services-OWL-S-Upper ontology-WSDL-S,OWL-S to UDDI mapping ,Design of the search engine,implementations.

Text Books:

1. Liyang Yu , "Introduction to the Semantic Web and Semantic web services" Chapman & Hall/CRC, Taylor & Francis group, 2007.

Reference:

2. Johan Hjelm, "Creating the Semantic Web with RDF", Wiley,2001
3. Grigoris Antoniou and Frank van Harmelen, "A Semantic Web Primer", MIT Press, 2012.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

Semester III

MCA (AI)

3L + 0T + 0P + 3C

MCAAI 315: BUSINESS INTELLIGENCE

MM 100

COURSE OBJECTIVE: To understand information Systems with comprehensive and in-depth knowledge of Business Intelligence

COURSE OUTCOME:

The student will be able to:

CO1: Define & understand Business Applications of BI
CO2: Describe data quality
CO3: Understand enterprise reporting
CO4: Design ER Modeling
CO5: Perform Association rules mining

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Introduction to Business Intelligence	6
2	Basics of Data Integration	5
3	Introduction to Multi-Dimensional Data Modeling	6
4	Basics of Enterprise Reporting	7
5	Data Mining Functionalities	5

Detailed Syllabus:

Unit 1: Introduction to Business Intelligence: Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities.

Unit 2: Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, introduction to ETL, Introduction to data quality, data profiling concepts and applications.

Unit 3: Introduction to Multi-Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using SSAS.

Unit 4: Basics of Enterprise Reporting

Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, and overall architecture

Unit 5: Data Mining Functionalities

Association rules mining, Mining Association rules from single level, multilevel transaction databases, Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbor classification, Cluster analysis, categorization of clustering methods.

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Text/ Reference Books:

1. R N Prasad, Seema Acharya: Fundamentals of Business Analytics, Wiley India, First Edition, 2011
2. J.Han and M. Kamber: Data Mining: Concepts and Techniques By Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition
3. David Loshin: Business Intelligence: The Savvy Manager's Guide., Latest Edition By Knowledge Enterprise.
4. Larissa Terpeluk Moss, Shaku Atre: Business Intelligence roadmap by Addison Weseley
5. Cindi Howson: Successful Business Intelligence: Secrets to making Killer BI Applications by Tata McGraw Hill

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	3	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	-	-	-	2
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	2	2
CO2	-	-	3
CO3	-	-	2
CO4	-	1	-
CO5	-	1	-

Semester III **MCA (AI)**

MCAAI 316: BIO INFORMATICS

3L + 0T + 0P + 3C **MM 100**

COURSE OBJECTIVE: To develop the ability to design, predict, analyze and compare the protein structures as well as predict the function of target proteins.

COURSE OUTCOME:

The student will be able to:

- Understand the fundamental concepts of structural biology
- To Understand and use structural databases and software for structure visualization
- To understand the algorithms used in Structure determination and quality assessment

OUTLINE OF THE COURSE

Unit No	Title of Unit	Time Required for Unit(Hours)
1	Evolution and inheritance	6
2	Concept of cell-cycle and its regulation	5
3	Concepts of transciptome	6
4	Databases	7
5	Computational tools	5

Detailed Syllabus:

Unit 1: Evolution and inheritance. Concept of gene, genetic material and genome. Chemistry of nucleic acids - structure and chemical composition of DNA and RNA.

Unit 2: Concept of cell-cycle and its regulation. Replication of genome, molecular basis of genome evolution. Molecular biology of gene functions (transciption and translation.

Unit 3: Concepts of transciptome, proteome and metabolome. Genomics (genome projects, concepts of structural and functional genomics).

Unit 4: Databases, DNA sequence analysis, protein sequence analysis. Introduction to Neurobiology, Signal Transduction.

Unit 5: Computational tools and techniques for Bioinformatics.

Text Book:

3. Phillip Compeau, Pavel Pevzner, Bioinformatics Algorithms: an Active Learning Approach
4. Neil C. Jones, Pavel Pevzner, Introduction to Bioinformatics Algorithms, ANE Books, 1st Edition edition (1 December 2009)

Books/References:

5. Molecular Cell Biology by Daid Baltimar
6. Aurther M. Lesk, Introduction to Bioinformatics, Oxford University Press, 4th edition (2014)
7. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bioinformatics Krane and Raymer, DORLING KINDERSLEY (RS); First edition (2003)

8. David Mount : Bioinformatics: Sequence and Genome Analysis, CBS; 2 edition (2005)

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	–	–
CO-2	1	–	–
CO-3	2	–	–
CO-4	2	–	–
CO-5	1	–	–

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TEACHING AND EXAMINATION SCHEME FOR

Master of Computer Application

(Specialization in Artificial Intelligence)

SEMESTER-IV

Course code	Course type	Course Name	Teaching Scheme			Total Hour	Credit
			L*	T*	P*		
MCA 401	PSIT	Project Phase – II/Industry Internship	-	-	-	16	16
		Total	-	-	-	**16**	**16**

AI - Artificial Intelligence

L*-Lecture*, T*-Tutorial, P*-Practical

Semester IV **MCA (AI)**

MCA 401: PROJECT PHASE - II/INDUSTRY INTERNSHIP

0L+0T+0P+16C **MM:100**

COURSE OVERVIEW AND OBEJCTIVES: To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The practical training aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

COURSE OUTCOME:

The student will be able to:

CO 1: develop the work practice
CO 2: solve real life problems related to industry
CO 3: better insight in the practical aspects of the industry
CO 4: facilitate the transition from the thorough theoretical education
CO 5: acquaintance with the culture of companies

Details:

The purpose of practical training is not only to get acquainted with the culture of companies, but also to realize something of importance for the company visited. By working in a group within the company, it is expected that the trainee gets a better insight in the practical aspects of the industry. This is intended to facilitate the transition from the thorough theoretical education, dispensed at our University, into an industrial professional career.

CO-PO Mapping

CO and PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	1	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	1	-	2	-	-	3	-

CO-PSO Mapping

CO and PSO	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	3
CO3	-	-	1
CO4	2	-	-
CO5	1	-	-