

# **Master of Computer Application**

Academic Year: 2025-2027

Syllabus

## **Vision**

To develop the Department of Computer Science & Information Technology as a Center for Excellence to produce leading Professionals who can serve the society with innovative skills, Computer Experts, Researchers to meet the needs of the software industry in national/global scenario responding to the challenges of ever changing world.

## **Mission**

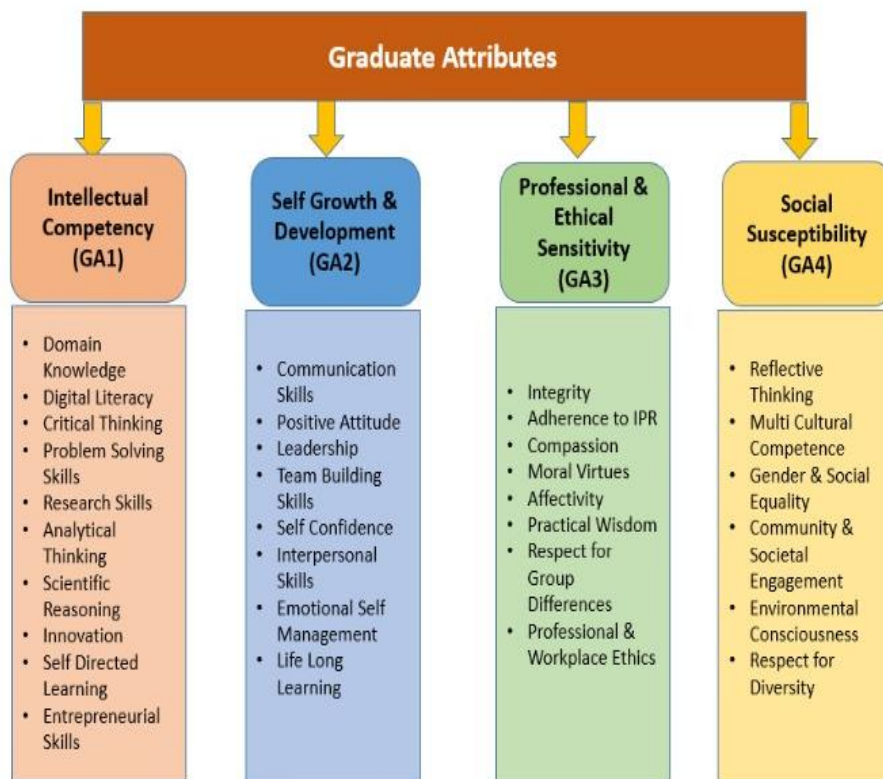
- We endeavour to provide the best possible learning environment to enhance innovations, research capabilities, problem solving skills, leadership qualities, team spirit and ethical responsibilities.
- To nurture the talent of the students to be successful, ethical and effective problem solvers who will contribute positively to the economic growth of the nation and prepare to respond to the challenges.

## Graduate Attributes

Jharkhand Rai University is a mecca of transformative education which strongly believes in the holistic development of students. The university provides the cutting-edge of holistic learning to develop promising youngsters into leaders of tomorrow with globally relevant, future-ready and actionable intelligence. The objective of the Department is to make each student proficient in synthesizing/analysing information and be ethical, socially responsible, and just when making decisions. JRU ensures inclusive and equitable quality education and promote lifelong learning opportunities for all.

**Every graduate of the Department will be developed to possess the following attributes:**

1. Intellectual Competency
2. Self-Growth & Development
3. Professional & Ethical Sensitivity
4. Social Susceptibility



## **PROGRAM EDUCATIONAL OBJECTIVES (PEO)**

- **PEO1:** To develop the conceptual and technical skills to provide solutions to problems across the broad range of application domain through analysis and design.
- **PEO2:** To develop good professional skills with a positive attitude for design, development of software and its computation.
- **PEO3:** To develop the leadership and managerial skills along with ethical practices, social concern and will be able to communicate technical information effectively.
- **PEO4:** To create scientific and societal advancement through technological innovation and entrepreneurship.
- **PEO5:** To inculcate the aptitude for self-development, continuous learning to be applied in industries.

## **PROGRAMME OUTCOME (PO)**

- **PO1:** Understand computational knowledge with problem analytical skills to provide IT enabled solutions.
- **PO2:** Ability to analyze the computing problems and develop computer programs/ application software by using algorithms and mathematical concepts.
- **PO3:** Apply moral, ethical and societal principles for professional computing practices.
- **PO4:** To be prepared to adopt new technology with unprecedented ideas to be a successful entrepreneur who can be a job creator.
- **PO5:** Recognize the need for and be prepared with the ability to engage in independent and life-long learning attitude in the broadest context of technological change.

## Mapping of PEO and PO

Program Outcome (PO)	Program Educational Objective (PEO)				
	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	✓	✓			
PO2	✓	✓			
PO3			✓		
PO4				✓	
PO5					✓
PO6					✓

### Course Component of MCA program having 98 Credits

Category of Course	PEOs	Curriculum Content (Total No. of Credits of the Programme)	Curriculum Content (% of Total number of credits of the Program)
Core courses focused on employability /skill development	PEO1, PEO2	78	87
Dept. Elective Courses focused on employability /Skill development	PEO2	8	9
Open Elective	PEO5	0	0
Courses focused on entrepreneurship	PEO4	0	0
Value added courses imparting transferable and life skills	PEO2, PEO3	4	4

## Course Scheme

MCA (2025-2027)												
MASTER OF COMPUTER APPLICATION												
SEMESTER I												
S. No	CATEGOR Y	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Assignment	T A	Total	E S E		
1	Information Technology Core	3CIT101	Advance Database Management System	3	0	0	20	10	30	70	100	3
2	Information Technology Core	3CIT102	Operating System	3	0	0	20	10	30	70	100	3
3	Information Technology Core	3CIT103	Computer Organization & Architecture	3	0	0	20	10	30	70	100	3
4	Information Technology Core	3CIT104	Advance Data structure	3	0	0	20	10	30	70	100	3
5	Mathematics	3CMT101	Discrete Mathematics	4	0	0	20	10	30	70	100	4
6	Humanities and Social Sciences	3CHSMC101	Soft Skills and Interpersonal Communication	2	0	0	20	10	30	70	100	2
7	Value Added	3CMVAC101	Character Building & Holistic Development of Personality-I	2	0	0	20	10	30	70	100	2
PRACTICAL /SESSIONAL												
1	Information Technology Core	3CIT101 P	Advance Database Management System Lab	0	0	4			30	20	50	2
2	Information Technology Core	3CIT104 P	Advance Data structure Lab	0	0	4			30	20	50	2
									<b>TOTAL</b>	<b>700</b>	<b>24</b>	

MASTER OF COMPUTER APPLICATION												
CHOICE BASED CREDIT SYSTEM												
SEMESTER II												
S. No.	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Assignment	T A	Total	E S E		
1	Information Technology Core	3CIT105	Java Programming	3	0	0	20	10	30	70	100	3
2	Information Technology Core	3CIT106	Computer Communication	4	0	0	20	10	30	70	100	4
3	Information Technology Core	3CIT107	Theory of Computation	3	0	0	20	10	30	70	100	3
4	Information Technology Core	3CIT108	Software Engineering	4	0	0	20	10	30	70	100	4
5	Mathematics	3CMT102	Optimization Techniques Linear Programming	4	0	0	20	10	30	70	100	4
6	Departmental Elective I			3	0	2	20	10	30	70	100	4
7	Humanities and Social Sciences	3CHSMC102	Professional Skills	2	0	0	20	10	30	70	100	2
8	Value Added	3CMVAC102	Character Building & Holistic Development of Personality-II	2	0	0	20	10	30	70	100	2
PRACTICAL /SESSIONAL												
1	Information Technology Core	3CIT105P	Java Programming Lab	0	0	4			30	20	50	2
									<b>TOTAL</b>	<b>750</b>	<b>28</b>	

MASTER OF COMPUTER APPLICATION												
CHOICE BASED CREDIT SYSTEM												
SEMESTER III												
S. No	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Assignment	TA	Total	ESE		
1	Information Technology Core	3CIT201	Artificial Intelligence	3	0	0	20	10	30	70	100	3
2	Information Technology Core	3CIT202	Data Mining and Warehousing	4	0	0	20	10	30	70	100	4
3	Information Technology Core	3CIT203	Python Programming	3	0	0	20	10	30	70	150	3
4	Departmental Elective II			3	0	2	20	10	30	70	100	4
5	Value Added	3CMVAC201	Character Building & Holistic Development of Personality-III	2	0	0	20	10	30	70	100	2
PRACTICAL /SESSIONAL												
1	Information Technology Core	3CIT201P	Artificial Intelligence Lab	0	0	4			30	20	50	2
2	Information Technology Core	3CIT203P	Python Programming Lab	0	0	4			30	20	50	2
3	Project	3CPROJ201	Project-I	0	0	8			100	100	200	4
									<b>TOTAL</b>	<b>750</b>	<b>24</b>	

MASTER OF COMPUTER APPLICATION												
CHOICE BASED CREDIT SYSTEM												
SEMESTER IV												
S. No.	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Assignment	T A	Total	E S E		
PRACTICAL / SESSIONAL												
1	Project	3CPROJ20 2	Project-II	0	0	40			600	200	800	20
2	Value Added	3CMVAC2 02	Character Building & Holistic Development of Personality-IV	2	0	0						2
3	University Mandatory Course	3CMUMC1 01	Managing Personal Finance##	2	0	0						0
									<b>TOTAL</b>			<b>22</b>

## Detailed Assessment Scheme

Assessment Scheme					
CIA- Continuous Internal Assessment (50 Marks)					
Assessment Parameters	Assessment Tools	Marks	Percentage (%)	Bloom's Taxonomy Category	Bloom's Taxonomy Level LOT/HOT
Assignment 1	Assignment consisting of minimum 5 Questions	10	20	Remember, Understand, Apply	LOT
Assignment 2	Assignment consisting of minimum 2 Questions	10	20	Analyse, Evaluate, Create	HOT
Teacher Assessment/ Class Participation					
Teacher Assessment 1	Quiz, Case Studies, Presentations, Group Discussion, Lab work, Project or any other activity	10	20	Remember, Understand, Apply	LOT
Teacher Assessment 2	Quiz, Case Studies, Presentations, Group Discussion, Lab work, Project or any other activity	10	20	Analyse, Evaluate, Create	HOT
Class Participation	Brainstorming, Discussion, Attendance, Extempore or any other activity	10	20		

(LOT: Low Order Thinking, HOT: High Order Thinking)

'ESE- End Semester Examination (70 Marks)			
Bloom's Taxonomy Category	ESE Question Paper Section	Percentage (%)	Bloom's Taxonomy Level LOT/HOT
Remember	A	30	LOT
Understand	A		
Apply	B	40	LOT/ HOT
Analyse	B		
Evaluate & create	C	30	HOT

# Semester I

SEMESTER I												
S. No	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject	Credit
				L	T	P	Assignment	T A	Total	E S E	Total	
1	Information Technology Core	3CIT101	Advance Database Management System	3	0	0	20	10	30	70	100	3
2	Information Technology Core	3CIT102	Operating System	3	0	0	20	10	30	70	100	3
3	Information Technology Core	3CIT103	Computer Organization & Architecture	3	0	0	20	10	30	70	100	3
4	Information Technology Core	3CIT104	Advance Data structure	3	0	0	20	10	30	70	100	3
5	Mathematics	3CMT101	Discrete Mathematics	4	0	0	20	10	30	70	100	4
6	Humanities and Social Sciences	3CHSMC101	Soft Skills and Interpersonal Communication	2	0	0	20	10	30	70	100	2
7	Value Added	3CMVAC101	Character Building & Holistic Development of Personality-I	2	0	0	20	10	30	70	100	2
PRACTICAL /SESSIONAL												
1	Information Technology Core	3CIT101P	Advance Database Management System Lab	0	0	4			30	20	50	2
2	Information Technology Core	3CIT104P	Advance Data structure Lab	0	0	4			30	20	50	2
									<b>TOTAL</b>	<b>700</b>	<b>24</b>	

**Program:** MCA

**Semester:** First

**Course:** Advanced Database Management System

**Course Code:** 3CIT101

L	T	P	C
3	0	0	3

---

### Course Objectives:

The objective of this course is:

- To introduce the fundamental concepts and architecture of database systems.
- To develop understanding of the relational model, relational algebra, and SQL.
- To explain database design using functional dependencies and normalization.
- To teach transaction processing and concurrency control techniques.
- To explore distributed databases and client-server architecture.

### Course Outcomes:

After the successful completion of the course, the students will be able to:

- CO1:** Describe the purpose, architecture, and components of database systems.
- CO2:** Apply relational algebra and SQL to design and query relational databases.
- CO3:** Normalize database schemas using functional dependencies and normal forms.
- CO4:** Analyze transaction states, concurrency control, and recovery techniques.
- CO5:** Explain the architecture and operations of distributed and client-server databases.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>Introduction and Conceptual Modelling:</b> Purpose of Database Systems, Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database languages, Database Architecture, Classification of DBMS, relational database, Database users and Administrators, Advantages of DBMS. Entities and Entity Sets, Relationships and Relationship Sets, Keys, Mapping, Constraints, ER Diagram, Reducing ER Diagram to tables, Generalization and Specialization, Aggregation, <b>From Vedic Knowledge Repositories to Modern Databases.</b>	7
<b>Unit II</b>	
<b>Relational Model: Concepts, Constraints, Languages, Design and Programming:</b> Relational database Schemas, Relational Algebra, Relational Calculus (Tuple Relational calculus and Domain Relational calculus), Update operations, Transactions, Dealing with constraint violations. Binary Relational operation: JOIN and DIVISION, SQL, More complex SQL Queries, Security & Integrity violations, authorization and views, integrity constants, encryption, Statistical databases	7
<b>Unit III</b>	
<b>Database Design Theory and Methodology:</b> Pitfalls in relational database design, Functional Dependencies, Decomposition Using Functional Dependencies. Normalization using functional Dependencies, General Definition of First, Second, Third and Forth Normal Form. Boyce-Codd Normal Form(BCNF), Multivalued and join dependencies, DKNF.	6
<b>Unit IV</b>	
<b>Transaction Processing Concepts and Concurrency Control Techniques:</b> Transaction Processing, Desirable Properties of Transactions, Transaction State, Characterizing Schedules based on Recoverability and Serializability. Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity, Deadlock Handling, Recovery and Atomicity, Log-Based Recovery.	5
<b>Unit V</b>	
<b>Distributed Databases and Client-Server Architectures:</b> Concepts and Types of Distributed databases, data fragmentation, Replication and Allocation Techniques for Distributed Database Design, Query Processing in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases, An Overview of 3-Tier Client-Server Architecture.	5

**Text Book:**

1. Elmasri Ramez, & Navathe S.B., “Fundamentals of Database Systems”, 5th Edition, Pearson Education, 2006.

**Reference Book:**

1. Silberschatz A., &Korth H., “Database Systems Concepts”, 5th Edition, McGraw Hill Higher Education, 2005.

**Program:** MCA

**Semester:** First

**Course:** Advance Database Management System Lab

**Course Code:** 3CIT101P

L	T	P	C
0	0	4	2

---

### Course Objectives:

The objective of this course is:

- To familiarize students with basic SQL syntax and querying techniques.
- To develop the ability to retrieve and manipulate employee and departmental data from relational databases.
- To introduce advanced SQL operations - aggregation, sorting, grouping, and subqueries.
- To enable learners to use functions and expressions for real-world decision-making and data formatting.
- To apply conditional logic and dynamic query generation using user input and expressions.

### Course Outcomes:

After the successful completion of the course, the students will be able to:

- CO1:** Write SQL queries to extract specific data using SELECT, WHERE, and logical conditions.
- CO2:** Perform data sorting, filtering, and pattern matching with ORDER BY, LIKE, IN, and BETWEEN clauses.
- CO3:** Use aggregate functions (MIN, MAX, AVG, COUNT) and GROUP BY to summarize employee data.
- CO4:** Apply conditional expressions using CASE and IF to create customized outputs and reports.
- CO5:** Demonstrate the ability to analyze employee records and generate insights using nested queries and joins.

**Course Content:**

For the Tables given below:

**emp(empno, ename, job, mgr, hiredate, sal, comm, deptno, gr),**  
**dept(deptno, dname, loc)**

Write the following queries:

1. List all information about all department from emp table.
2. List all employee names along with their salaries from emp table.
3. List all department numbers, employee numbers and their manager's numbers in descending order of deptno from emp table.
4. List department names and locations from the dept table.
5. List the employees belonging to the department 20.
6. List the name and salary of the employees whose salary is more than 1000.
7. List the names of the clerks working in the department 20.
8. List the names of analysts and salesmen.
9. List the details of the employees who have joined before the end of September 81.
10. List the names of employees who are not managers.
11. List the names of employees whose employee number are 8569, 8521, 8839, 8934, 8788.
12. List the employee details not belonging to the department 10, 30, and 40.
13. List the employee name and salary, whose salary is between 5000 and 10,000.
14. List the employee names, who are not eligible for commission.(salary having >15,000 eligible for commission)
- 15 List the employees who are eligible for commission
16. List the details of employees, whose salary is greater than 2000 and commission is NULL.
17. List the employees whose names start with an "S" (not"s").
18. List the name, salary and PF amount of all the employees(PF is calculated as 10% of salary).
19. List the empno, ename, sal in ascending order of salary.
20. List the employee name, salary, job and Department no descending order of Department No and salary.
21. List the employee details in ascending order of salary.
22. List the employee details in descending order of salary
23. Display name, and sal and commission of all employees whose monthly salary is greater than their commission.
24. Select SMITH HAS WORKED IN THE POSITION OF CLERK IN DEPT 20.Display result in this format.
25. Generate a statement which prompts the user at runtime. The intention is to display employees hired between 2 given dates.
26. Define a variable representing an expression used to calculate total annual remuneration. Use the variable in a statement which finds all employees who earn \$30000 a year or more.
27. List all the employees name and salaries increased by 15% and expressed as a whole number of dollar

28. Produce the following

EMPLOYEE	JOB
SMITH	CLERK
ALLEN	SALESMAN

29. Produce the following output: SMITH( Clerk) ALLEN( Salesman)

30. Do a case sensitive search for a list of employees with a job that the user enters.

31. It has been discovered that the sales people in dept. 30 are not all male. Please produce the following output.

ENAME	DEPTNO	JOB
ALLEN	30	Sales Person

32. Display each employees name and hire date of dept 20.

33. Display each employees name, hire date and salary review date. Assume salary review date is one year from hire date. Output should be in ascending review date.

34. Print list of employees displaying just salary, if more than 1500. If exactly 1500 display “ On Target”. If less than 1500 display “ Below 1500”.

35. Write a query which returns DAY of the week ( i.e. MONDAY) for any date entered in the format DD/MM/YY.

36. Write a query to calculate length of service of each employee.

37. Find the minimum salary of all employees.

38. Find the maximum, minimum, and average salaries of all employees.

39. List the maximum and minimum salary of each job type.

40. Find how many managers are in each dept.

41. Write a query which returns DAY of the week ( i.e. MONDAY) for any date entered in the format DD/MM/YY.

42. Write a query to calculate length of service of each employee.

43. Find the minimum salary of all employees.

44. Write a query which returns DAY of the week ( i.e. MONDAY) for any date entered in the format DD/MM/YY.

45. Write a query to calculate length of service of each employee.

46. Find the minimum salary of all employees.

47. Find the maximum, minimum, and average salaries of all employees.

48. List the maximum and minimum salary of each job type.

49. Find how many managers are in each dept.

50. Find the average salary and average total remuneration of each job type. Remembers sales man earn commission.

51. Find out the difference between highest and lowest salary.

52. Find all department s which have more than three employees.

53. Check whether all employee nos are unique. ( No Duplicate)

54. List lowest paid employee working for each Manager. Exclude any groups where the minimum salary is less than 1000. Sort the output by salary.

55. Produce a list showing employees ‘salary grade’.(> 10000 A, >10000 &<20000 B,>20000 C)

56. Show only employee on Grade C.

48. .Show all employee in Dallas.

49. List the employees name, job, salary, grade and department for everyone in the company except clerks. Sort on salary, displaying the highest first.
50. List the following details of employees who earn \$36000 a year or who are clerks.

<b>ename</b>	<b>job</b>	<b>annual sal</b>	<b>dept no</b>	<b>dname</b>	<b>grade</b>
--------------	------------	-------------------	----------------	--------------	--------------

51. Display all employees who earn less than their managers.
52. Display all employees by name and eno along with their managers name and number.

**Program:** MCA

**Semester:** First

**Course:** Operating System

**Course Code:** 3CIT102

L	T	P	C
3	0	0	3

---

**Course Objective:**

The objective of this course is:

- To understand the basic concepts and types of Operating Systems.
- To learn process, thread, and scheduling mechanisms.
- To study memory management and deadlock handling.
- To explore file systems, I/O operations, and disk management.

**Course Outcomes:**

After the successful completion of the course, the students will be able to:

- CO1:** Describe OS structures and services with examples.
- CO2:** Analyze and apply process scheduling and IPC techniques.
- CO3:** Explain memory allocation and virtual memory concepts.
- CO4:** Demonstrate knowledge of file handling and I/O systems.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<p><b>Introduction:</b> Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.</p> <p><b>Processes:</b> Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching</p> <p><b>Thread:</b> Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, <b>Insights from Indian Philosophical Systems Applied to Resource Sharing, Scheduling, and System Management.</b></p>	7
<b>Unit II</b>	
<p><b>Process Scheduling:</b> Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.</p> <p><b>Inter-process Communication:</b> Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's &amp; Writer Problem, Dinning Philosopher Problem etc.</p>	9
<b>Unit III</b>	
<p><b>Deadlocks:</b> Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.</p> <p><b>Memory Management:</b> Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.</p> <p><b>Virtual Memory:</b> Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).</p>	8
<b>Unit IV</b>	
<p><b>I/O Hardware:</b> I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms</p> <p><b>File Management:</b> Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free- space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.</p>	6

**Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

**Suggested books:**

1. Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

**Suggested reference books:**

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

**Program:** MCA

**Semester:** First

**Course:** Computer Organization & Architecture

**Course Code:** 3CIT103

L	T	P	C
3	0	0	3

---

### **Course Objectives:**

The objective of this course is:

- To Understand digital logic design using Boolean algebra and logic circuits.
- To Learn instruction set architecture and assembly language programming.
- To Explore the functioning of processing units and pipelining.
- To Understand memory types, hierarchy, and management techniques.
- To Comprehend I/O mechanisms and parallel processing concepts.

### **Course Outcomes:**

After the successful completion of the course, the students will be able to:

- CO1:** Design and analyze logic circuits using Boolean expressions and Karnaugh maps.
- CO2:** Implement instructions and addressing modes in assembly language.
- CO3:** Describe and evaluate basic processing units and pipelined architectures.
- CO4:** Understand memory organization, virtual memory, and cache systems.
- CO5:** Analyze I/O operations and parallel processing systems (SIMD, MIMD).

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>INTRODUCTION</b> <b>Digital Logic Design:</b> Axioms and laws of Boolean algebra, Reduction of Boolean expressions, conversion between canonical forms, Karnaugh map (4 variable), Half Adder, full adder, 4-bit parallel parity bit generator, checker circuit, Decoder, Encoder, Multiplexer, IC RAM, ROM, Memory Organization, Sequential Circuits, State transistors, Flip-flop, RS, JK, D-Latch, Master-slave, <b>From Panini's Grammar Rules to Modern Instruction Sets: Logic, Structure, and Sequencing in Indian Knowledge Traditions.</b>	7
<b>Unit II</b>	
<b>INSTRUCTION SET ARCHITECTURE</b> <b>Memory Locations and Addresses:</b> Byte Addressability, Big-Endian and Little-Endian Assignments, Word Alignment, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Subroutines, Additional Instructions, dealing with 32-Bit Immediate Values.	7
<b>Unit III</b>	
<b>BASIC PROCESSING UNIT &amp; PIPELINING</b> <b>Basic Processing Unit:</b> Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors. <b>Pipelining:</b> Basic Concept, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Pipeline Performance Evaluation.	6
<b>Unit IV</b>	
<b>MEMORY ORGANIZATION</b> Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual Memory, Memory Management Requirements, Secondary Storage	5
<b>Unit V</b>	
<b>INPUT OUTPUT &amp; PARALLEL PROCESSING</b> <b>Basic Input Output:</b> Accessing I/O Devices, Interrupts, Input Output Organization: Bus Structure, Bus Operation, Arbitration, Interface, Interconnection Standards. <b>Parallel Processing:</b> Hardware Multithreading, Vector (SIMD) Processing, Shared-Memory Multiprocessors, Cache Coherence, Message-Passing Multicomputers, Parallel Programming for Multiprocessors, Performance Modeling.	5

**Books recommended: Text Book**

1. Hamacher Carl, et. al, "Computer Organization and Embedded Systems", 6th Edition, Tata McGraw Hill, New Delhi, 2011.(T1)
2. Patterson David A., "Computer Organization and Design: The Hardware Software / Interface", 5th Edition, 1994.(T2)
3. Mano M. Morris, "Computer System Architecture", Revised 3rd Edition, Pearson Education.(T3)

**Program:** MCA

**Semester:** First

**Course:** Advance Data structure

**Course Code:** 3CIT104

L	T	P	C
3	0	0	3

---

### Course Objective:

The objective of this course is:

- To learn basic linear data structures (arrays, linked lists).
- To understand and apply stacks and queues.
- To study tree structures and traversal techniques.
- To analyze sorting and heap algorithms.
- To explore graph data structures and algorithms.

### Course Outcomes

After the successful completion of the course, the students will be able to:

- CO1:** Implement arrays and linked lists.
- CO2:** Solve problems using stacks and queues.
- CO3:** Build and traverse trees effectively.
- CO4:** Compare and use sorting and heap methods.
- CO5:** Apply graph algorithms to real-world problems.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
Fundamental Data Structures: Using Arrays, Singly Linked Lists, Circularly Linked Lists, Doubly Linked Lists, Asymptotic Analysis, <b>Ancient Indian Pedagogical Structures and Their Reflection in Hierarchical Data Models</b>	7
<b>Unit II</b>	
Stacks, Queues, Dequeues: The Stack, Queue, Dequeue ADTs, Simple Array Based Stack, Queue, Dequeue Implementation, Implementing Stack, Queue with Singly Linked List, Reversing an Array using Stack, Matching Parenthesis and HTML tags, A Circular Queue.	7
<b>Unit III</b>	
Trees: General Trees, Binary Trees, Implementing Trees, Tree Traversal Algorithms, BinarySearch Trees, AVL Trees, B Trees.	6
<b>Unit IV</b>	
Sorting: Merge sort, Quick sort, Studying sorting through algorithmic lens, Comparing SortingAlgorithms. Heap: Priority Queues, Array Implementation of Heaps, Construction of Heaps, Heap Sort.	5
<b>Unit V</b>	
Graphs: Data Structures for graphs, Graph Traversals, Transitive Closure, Directed Acyclic Graphs, Shortest Paths, Minimum Spanning Trees	5

**Text book:**

1. Goodrich Michael T., Tamassia Roberto, Goldwasser Michael H. “Data Structures and Algorithms in Java”, Wiley, 6th Edition, 2014.
2. Klein Shmuel Tomi, Basic Concepts in Data Structures, Cambridge University Press, 1st Edition, 2016.

**Reference books:**

1. YedidyahLangsam, Moshe Augenstein J., Tenenbaum Aaron M. “Data Structures using JAVA”, Pearson Education, 2009.
2. Brass Peter “Advanced Data Structures”, Cambridge University Press, 1st Edition.

**Program:** MCA

**Semester:** First

**Course:** Advance Data structure Lab

**Course Code:** 3CIT104P

L	T	P	C
0	0	4	2

---

### Course Objective:

The objective of this course is:

- To understand basic data structures like arrays, stacks, queues, and linked lists.
- To implement data structure operations using C.
- To use pointers for dynamic memory and linked structures.
- To build and traverse tree structures (binary, AVL, B-tree).
- To apply sorting and searching techniques in problem-solving.

### Course Outcomes:

After the successful completion of the course, the students will be able to:

- CO1:** Implement linear data structures using arrays and pointers.
- CO2:** Perform operations on single, double, and circular linked lists.
- CO3:** Develop tree-based programs with insertion, deletion, and traversal.
- CO4:** Apply sorting/searching algorithms using arrays and pointers.
- CO5:** Use stacks for expression conversion and queues for scheduling problems.

**Course Content:**

**Program List:**

1. Program to Find the Number of Elements in an Array
2. Develop and Implement a menu driven program in C for the following Array operations
  - (a) Creating Array of N Integer elements.
  - (b) Display of Array elements with suitable headings.
  - (c) Inserting an element (ELEM) at a given valid position (POS).
  - (d) Deleting an element at a given valid position (POS).
  - (e) Exit
3. Programs for Stack, Queues and Circular Queues using Arrays
4. Program to convert an Infix Expression into Postfix and Postfix Evaluation
5. Program to implement stack using arrays
6. Program to implement stack using linked list
7. Program to implement multiple stack in a single array
8. Program to convert infix notation to postfix notation using stacks
9. Program to implement queue using arrays
10. Program to implement queue using pointers
11. Program to reverse elements in a queue
12. Program to implement circular queue using arrays
13. Program to create add remove & display element from single linked list
14. Program to create add remove & display element from double linked list
15. Program to count number of nodes in linear linked list
16. Program to create add remove & display element from circular linked list
17. Programs to implement stack & queues using linked representation
18. Program to concatenate two linear linked lists
19. Program to accept a singly linked list of integers & sort the list in ascending order.
20. Program to reverse linked list
21. Program to represent polynomial using linked list
22. Program to add two polynomials using linked list
23. Program for the creation of binary tree, provide insertion & deletion in c
24. Program for pre-order, post-order & in-order traversals of a binary tree using non recursive.
25. Program to count no, of leaves of binary tree
26. Program for implementation of B-tree (insertion & deletion)
27. Program for implementation of multi-way tree in c
28. Program for implementation of AVL tree
29. Program to implement bubble sort program using arrays
30. Program to implement merge sort using arrays
31. Program to implement selection sort program using arrays
32. Program to implement insertion sort program using arrays
33. Program to implement topological sort using arrays
34. Program to implement heap sort using arrays

35. Program to implement heap sort using pointers
36. Program to implement bubble sort program using pointers
37. Program to implement linear search using pointers
38. Program to implement binary search using pointers
39. Program to implement linear search using arrays
40. Program to implement binary search using arrays

**Text books:**

1. Baluja G S, “Data Structure through C”, Ganpat Rai Publication, New Delhi, 2015.
2. Pai G A V, “Data Structures and Algorithms: Concepts, Techniques and Applications”, 2ndEdn, Tata McGraw-Hill, 2008.
3. Horowitz E., Sahni S., Susan A., “Fundamentals of Data Structures in C”, 2nd Edition,

**Program:** MCA

**Semester:** First

**Course:** Discrete Mathematics

**Course Code:** 3CMT101

L	T	P	C
4	0	0	4

---

### Course Objective:

The objective of this course is:

- To understand set theory, propositional logic, and proof techniques.
- To learn relations, functions, and counting methods relevant to computing.
- To study graphs and trees with focus on their representations and algorithms.
- To explore algebraic structures, Boolean algebra, and coding theory.

### Course Outcomes:

After the successful completion of the course, the students will be able to:

- CO1:** Solve problems using logic, set theory, and proofs.
- CO2:** Apply relations, functions, and counting in problem modeling.
- CO3:** Use graph and tree algorithms for computation and optimization.
- CO4:** Implement algebraic and coding concepts in digital systems.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<p><b>Sets and Proposition</b>  <b>Basics:</b> Finite and Infinite Sets, Combinations of Sets, Multisets, Venn Diagrams.  <b>Propositional Logic:</b> Propositions and Logical Operations, Functionally complete set of connectives, Well Formed Formulas, Laws of equivalence, Normal forms, Predicate calculus, Inference Theory.  <b>Notion of Proof:</b> Direct and Indirect Proof, Inductive proofs, <b>Indian Contributions to Logic and Mathematics: From Pingala's Combinatorics to Boolean Algebra.</b></p>	10
<b>Unit II</b>	
<p><b>Relations and Functions, Counting Techniques</b>  <b>Relations:</b> Properties of Relations, Matrices of relations, Closure operations on relations, Equivalence Relations, Computer Representation of Relations, Partial Ordering Relations and Lattices, Properties of Lattices, Hasse Diagram of partially ordered set.  <b>Functions:</b> Introduction to functions and its types, Function for Computer Science, Discrete numeric Functions, Composition of Functions, Invertible Functions, Recursive Functions, Generating functions.  <b>Counting-</b> Basics of Counting Techniques, Pigeonhole Principle, Generalized Permutations and Combinations, Recurrences Relations.</p>	10
<b>Unit III</b>	
<p><b>Graph Theory-</b> Basic Concept of Graph Theory and Terminology, representation of Graphs, Bipartite, Regular, Planar and connected graphs, reachability and connectedness.  Matrix representation of graphs, Storage representation and manipulation of graphs, Euler graphs, Hamiltonian path and circuits, graph traversals, shortest path in weighted graphs, Graph Isomorphism and Homomorphism.  <b>Trees:</b> Introduction, Undirected Trees, Binary search trees, Spanning trees, Minimum spanning trees, Kruskal's Algorithm, Prim's Algorithm.</p>	11
<b>Unit IV</b>	
<p><b>Group Theory</b>  <b>Algebraic Structures:</b> Definition, Properties, Types: Semi Groups, Monoid, Groups, Abelian group, Subgroup, cyclic groups, Factor group, Permutation groups, Normal subgroup, Cosets and Lagrange's Theorem, Homomorphism and Isomorphism of Groups.  <b>Boolean Algebra:</b> Boolean Functions, Representing Boolean Functions, Principal of Duality, Design and Implementation of Digital Networks, Karnaugh maps.</p>	9

**Coding Theory:** Codes and Groupcodes, Error detection and correction using Group codes, Hamming Code.

**Reference Books:**

1. K. E. Rosen, "Discrete mathematics and its applications", McGraw Hill International, 2<sup>nd</sup> Edition, 2011.
2. T.Veerarajan," Discrete Mathematics ". Tata McGraw Hill,2012.
3. B. Kolman, R. C. Busby, S. Ross, "Discrete Mathematical Structures", Prentice Hall of India, 6th. Edition, 2010.
4. S. Lipschutz, Discrete Mathematics, Tata McGraw Hill, 2nd. Edition, 2005
5. Richard Johnsonbough, "Discrete Mathematics", Pearson Education, 8th. Edition, 2018.

**Program:** MCA

**Semester:** First

**Course:** Soft Skills and Interpersonal Communication

**Course Code:** 3CHSMC101

L	T	P	C
2	0	0	2

---

### Course Objective:

The objective of this course is:

- To develop inter personal skills and be an effective goal oriented team player.
- To develop professionals with idealistic, practical and moral values.
- To develop communication, problem solving skills and understand its influence on behavior.
- To encourage the all-round development of students by focusing on soft skills.
- To make the engineering students aware of the importance, the role and content of soft skills through instruction, knowledge acquisition and demonstration.

### Course Outcome:

After the successful completion of the course, the students will be able to:

**CO1:** Understand the importance of Soft Skills and Interpersonal Communication in Professional world.

**CO2:** Effectively communicate through verbal /oral communication and improve the listening skills.

**CO3:** Become more effective individual through goal/target setting, self-motivation and practicing creative thinking.

**CO4:** Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, inter –personal relationships, conflict management and leadership quality.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>Self-Analysis :</b> Introduction to Soft Skills and Hard Skills, Importance of Soft Skills, Attributes regarded as Soft Skills, Identifying and improving your Soft Skills, Art of Negotiation , <b>Stage Fright :</b> Self-Discovery, Importance of knowing oneself, Process of knowing oneself, SWOT Analysis, Benefits of SWOT analysis, SWOT Analysis , Self Esteem, Ways to improve Self Esteem, Aristotle on Self-Gender and Self, Feminist Self, Escaping the Self , <b>Self-Development :</b> Developing Positive Attitude and Self Confidence, Forming Values, <b>Lessons from Chanakya and Indian Traditions of Dialogue for Modern Professional Skills.</b>	8
<b>Unit II</b>	
<b>Goal Setting and Career Planning :</b> Wish List, SMART Goals, Blue print for Success, Short term, Long Term, Life Time Goals, Art of Listening, Art of Reading, Art of Speaking, Art of Writing, writing E-mail, Motivation Skills, Personality Development, Improving Perception ,Time Management, Stress Management, Conflict Handling ,Problem Solving and Decision Making, adaptability.	7
<b>Unit III</b>	
<b>Effective Communication:</b> Communication Skills, Concept/Meaning, Definition -Types of Communication, Process of Communication, stages of Communication, Difference between General and Technical Communication, Barriers to Communication, Communication Network, 7 C's of Communication, Verbal & Nonverbal Communication	9
<b>Unit IV</b>	
<b>Interpersonal Skills :</b> Interpersonal Communication, Basic Skill set , Effective Interpersonal Communication in Organization, Team Building, Communicating in a Team ,Intercultural Communication , Leadership traits through Communication ,Communicating assertively ,Presentation Skills	6

**Suggested Readings:**

1. Covey Sean Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
2. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.
3. Thomas A Harris, I am ok, You are ok, New York-Harper and Row, 1972
4. Dr. K. Alex Soft Skills, S. Chand

**Program:** MCA

**Semester:** First

**Course:** Character Building & Holistic

Development of Personality-I

**Course Code:** 3CMVAC101

L	T	P	C
2	0	0	2

---

**Course Objective:**

The objective of this course is:

- To create awareness among students about Pancha Kosha and Annamaya Kosha and impart significance of good health.
- To prepare the students for playing positive role for self, family, society, nation and the world.
- To generate awareness about health through Yoga among students.
- To develop intellectual emotional development

**Course Outcome:**

On completion of the Course, the students will be able to:

**CO1:** Build a robust understanding of spiritual and mental health.

**CO2:** Evaluate human behavioral characteristics critically.

**CO3:** Apply the principles of yoga to improve their own well-being.

**CO4:** Foster independence and better manage their own conduct.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>Cognitive Development:</b> Pancha Kosha - General Introduction, Concept and its Importance (Indian concept of Pancha kosha) - Basic study of Pancha kosha described in Upanishads. Annamaya Kosha - Importance and significance of food in the process of construction, development and enrichment of the Annamaya Kosha ,External Personality - Importance and significance of the Annamaya Kosha. Development of Annamaya Kosha and the creation of a healthy, strong, vigorous, tolerant, elastic and elegant body. Dimensions - Physical Education, Sports, Health Education, Healthy food, Sanitation and Cleanliness, Physical Labour and Environmental Protection, <b>Pancha Kosha Concept from Upanishads: Integrating Ancient Insights into Holistic Personality Development.</b>	8
<b>Unit II</b>	
<b>Moral Spiritual Development:</b> Contribution of great Indian Personalities in the process of Character-Building and Personality Development (especially in the context of Human, Society and Nation building). Mahatma Buddha, Maharishi Valmiki, Sant Ravidass, Guru Jambheshwar and Guru Nanak Dev.	4
<b>Unit III</b>	
<b>Physical Development:</b> General Introduction: Exercises and Surya Namaskar. Asana - Introduction and types, (Asanas in standing position) - Tadaasana, Vrikshaasana, Chakraasana and Trikonaasana. Pranayama - Introduction: Deep-breathing, Anuloma-Viloma and Kapal-Bhati. Hasta Mudra – Introduction: Gyana Mudra and Vaayu Mudra	8
<b>Unit IV</b>	
<b>Intellectual – Emotional Development:</b> Self-Reliance, Nishkama Karma Yoga Etiquettes, Responsibility towards Society, Ideal Teacher, Moral Values, Time Management and the Goal of My Life.	4

**Suggested Reading:**

1. Personality Development, Swami Vivekananda, Advaita Ashram, Kolkata
2. Rabindranath Tagore : An Interpretation, Sabyasachi Bhattacharya, Penguin Delhi

# Semester II

SEMESTER II												
S. No.	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Assignment	T A	Total	E S E		
1	Information Technology Core	3CIT105	Java Programming	3	0	0	20	10	30	70	100	3
2	Information Technology Core	3CIT106	Computer Communication	4	0	0	20	10	30	70	100	4
3	Information Technology Core	3CIT107	Theory of Computation	3	0	0	20	10	30	70	100	3
4	Information Technology Core	3CIT108	Software Engineering	4	0	0	20	10	30	70	100	4
5	Mathematics	3CMT102	Optimization Techniques Linear Programming	4	0	0	20	10	30	70	100	4
6	Departmental Elective I			3	0	2	20	10	30	70	100	4
7	Humanities and Social Sciences	3CHSMC102	Professional Skills	2	0	0	20	10	30	70	100	2
8	Value Added	3CMVAC102	Character Building & Holistic Development of Personality-II	2	0	0	20	10	30	70	100	2
PRACTICAL /SESSIONAL												
1	Information Technology Core	3CIT105P	Java Programming Lab	0	0	4			30	20	50	2
									<b>TOTAL</b>	<b>750</b>	<b>28</b>	

**Program:** MCA

**Semester:** Second

**Course:** Java Programming

**Course Code:** 3CIT105

L	T	P	C
3	0	0	3

---

### Course Objectives:

The objective of this course is:

- To understand the core Java language features, OOP principles, and the Java execution environment.
- To develop the ability to implement classes, inheritance, exception handling, and interfaces in Java.
- To introduce Java I/O, multithreading concepts, and file handling using Java streams.
- To design interactive GUI applications and perform database connectivity using Java Swing and JDBC.

### Course Outcomes:

After the successful completion of the course, the students will be able to:

**CO1:** Demonstrate knowledge of Java fundamentals, data types, control structures, and OOP concepts.

**CO2:** Apply object-oriented principles like inheritance, polymorphism, and exception handling to build modular Java applications.

**CO3:** Develop applications using Java I/O streams and multithreading for efficient processing.

**CO4:** Design GUI-based applications and integrate Java programs with databases using JDBC.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
Java Fundamentals: Features of Java, OOPs concepts, Java virtual machine, Reflection byte codes, Byte code interpretation, Data types, variable, arrays, expressions, tokens, operators, and control structures, java environment setup, Objects and classes, <b>From Panini's Grammar Rules to Object-Oriented Paradigms: Structuring Knowledge through Reusable Patterns.</b>	8
<b>Unit II</b>	
Java Classes, Abstract classes, Static classes, Inner classes , access modifiers, static member, method overloading, method overriding, inheritance and its types, polymorphism, Packages ,Wrapper classes ,Interfaces ,abstraction, this keyword, Super, Exception handling, Exception as objects, Exception hierarchy, Try – catch, finally, Throw, throws.	8
<b>Unit III</b>	
IO package ,Input streams ,Output streams ,Object serialization ,Deserialization ,Sample programs on IO files ,Filter and pipe streams , Multi-threading ,Thread Life cycle ,Multi-threading advantages and issues ,Simple thread program ,Thread synchronization.	6
<b>Unit IV</b>	
GUI :Introduction to AWT programming ,Layout and component managers ,Event handling ,Applet class ,Applet life-cycle ,Passing parameters embedding in HTML ,Swing components – JApplet, JButton, JFrame, etc. ,Sample swing programs Database Connectivity, JDBC architecture , Establishing connectivity and working with connection interface.	8

**References**

1. Programming with Java, E. Balaguruswamys, TMH.
2. The Complete Reference-Java 2, Schildt, Herbert, TMH.
3. Core Java for beginners, RASHMI Kanta Das, Vikas pub.
4. Java server programming, Ivan Bayross, Shroff Publishers
5. Java Server Programming Java EE 7 (J2EE 1.7) - Black Book, Kogent, Dreamtech Press Senn, LA., "Analysis and Design of Information Systems". Tata McGraw Hill Book Company, 1986

**Program:** MCA

**Semester:** Second

**Course:** Java Programming Lab

**Course Code:** 3CIT105P

L	T	P	C
0	0	4	2

---

### **Course Objectives:**

The objective of this course is:

- To understand variables, control structures, functions, and arrays in Java.
- To develop object-oriented programs using classes, inheritance, and polymorphism.
- To utilize advanced Java features like packages, interfaces, multithreading, and GUI components.
- To apply Java for solving real-world problems using file handling, database access, and string/matrix operations.

### **Course Outcomes:**

After the successful completion of the course, the students will be able to:

**CO1:** Develop basic Java programs using control structures and arrays.

**CO2:** Apply object-oriented concepts like classes, inheritance, and polymorphism.

**CO3:** Implement advanced Java features like threads, applets, and GUI.

**CO4:** Use Java for real-world tasks such as string handling, form design, and database connectivity.

**Write a java:**

1. Program to find square root of given number.
2. Program to enter principal, rate & time and find simple interest.
3. Program to create an object.
4. Program to enter a character from keyboard and find out the ASCII value of the character.
5. Program to enter a number from keyboard and find out Fibonacci series.
6. Program to enter a number from keyboard and find out factorial of the number.
7. Program to enter a number from keyboard and print the prime numbers present within it.
8. Program to swap two numbers without using third variable.
9. Program to show inheritance.
10. Program to demonstrate dynamic method dispatch.
11. Program to demonstrate abstraction.
12. Program to enter a number from keyboard and convert it into binary form and vice-versa.
13. Program to sort an array in an ascending order.
14. Program to find out the sum and average of the elements present in an array.
15. Program to find out the biggest and smallest number from a matrix.
16. Program to enter a string from keyboard and check how many vowels and consonants are present.
17. Program to reverse a specified string.
18. Program demonstrating the use of package.
19. Program to show the current date, date after one day and date before ten days.
20. Program to draw the shape.
21. Program to find out the pixel color.
22. Program to move the bubbles using thread.
23. Program to create an applet.
24. Program to create a form using applet.
25. Program to show the database connectivity.

**Program:** MCA

**Semester:** Second

**Course:** Computer Communication Networks

**Course Code:** 3CIT106

L	T	P	C
4	0	0	4

---

### **Course Objectives:**

The objective of this course is:

- To understand fundamentals of computer networks and transmission methods.
- To learn layered protocols, OSI model, and LAN standards.
- To explore switching and routing techniques in networks.
- To study TCP/IP, IP addressing, and PC-based networking.

### **Course Outcomes:**

After the successful completion of the course, the students will be able to:

**CO1:** Identify network types, topologies, and communication methods.

**CO2:** Explain OSI layers and standard data link protocols.

**CO3:** Analyze switching, routing, and X.25 network functions.

**CO4:** Apply TCP/IP concepts and address PC networking solutions.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<p><b>Introduction to computer network</b> Advantages of networks, structure of the communications network, point-to-point and multidrop circuits, data flow and physical circuits, network topologies, topologies and design goals. Hierarchical topology, horizontal topology (Bus), star topology, ring topology, mesh topology. The telephone network, switched and non-switched options, fundamentals of communications theory, channel speed and bit rate, voice communications and analog waveforms, bandwidth and the frequency spectrum, connecting the analog and digital worlds, digital worlds, digital signals, the modem, asynchronous and synchronous transmission.</p> <p>Wide area and local networks, connection oriented and connectionless networks, classification of communications protocols, time division multiple access (TDMA), time division multiplexing (TDM), carrier sense (Collision) systems, token passing, peer-to-peer priority systems; priority slot, carrier sense (collision free) systems, token passing (priority) systems, <b>Ancient Indian Communication Systems: From Nāḍī (Channels) in Ayurveda to Network Protocols in Modern Computing.</b></p>	7
<b>Unit II</b>	
<p><b>Layered Protocols and the OSI model</b> Goals of Layered Protocols, network design problems" communication between layers, introduction to standard organizations and the OSI model, standards organizations, Layers of OSI, OSI status.</p> <p><b>Polling/Selection Protocols</b> Character and bit protocols, binary synchronous control (BSC) HDLC; HOLC options, HDLC frame format, code transparency and synchronization, HDLC transmission process, HDLC subsets, SDLC;, Protocol conversion.</p> <p><b>Local Area Networks</b> Way LANs?, Primary attributes of a LAN, Broadband and baseband and base LANs, IEEE LAN standards, e lationship of the 802 standards to the ISO/CCITT model., connection options with LANs, LLC and MAC protocol data units, LAN topologies and protocols, CSMA/CO and IEEE 802.3, token ring (Priority), token bus and IEEE 802.4, metropolitan area networks (MANs), ANSI fibre distributed data interface.</p>	9
<b>Unit III</b>	
<p><b>Switching and Routing in Networks</b> Message switching, packet switching, when and when not to use packet switching, packet routing, packet switching support to circuit switching networks. <b>The X.25 Network and Supporting Protocols</b> Features of X.25, Layers of X.25 and the Physical layer, X.25 and the data link layer. companion standards to X.25, features of X.25, X.25 channel options, flow control principles, other packet types, X.25 logical channel states, packet formats. internetworking, connectionless mode networks, the frame relay and X.25 stacks</p>	8

<b>Unit IV</b>	
<p><b>TCP/IP</b> TCP/IP and internetworking, example of TCP/IP operations, related protocols ports and sockets. The IP address structure, major features of IP, IP datagram. Major IP services. IP source routing, value of the transport layer, TCP, Major features of TCP, passive and active operation, the transmission control block (TCP), route discovery protocols, examples of route discovery protocols, application layer protocols.</p> <p><b>Personal Computer Networks</b> Personal computer communications characteristics, error handling, using the personal computer as a server, linking the personal computer to mainframe computers, tilt: transfer on personal computers, personal computers and local area networks, network operating systems (NOSs), common IBM PC LAN protocol stacks.</p>	6

### **References**

1. Black, V., "Computer Networks: Protocols, Standards and Interfaces", Prentice Hall of India, 1996.
2. Stallings, W., "Computer Communication Networks", (4th edition). Prentice Hall of India. 1993.
3. Tannebaum, A.S .. "Computer Networks", Prentice Hall of India, 19'81.

**Program:** MCA

**Semester:** Second

**Course:** Theory of Computation

**Course Code:** 3CIT107

L	T	P	C
3	0	0	3

---

### **Course Objective:**

The objective of this course is:

- To understand basic mathematical tools like sets, logic, and induction.
- To learn regular expressions and finite automata design.
- To study regular and non-regular languages using grammars and lemmas.
- To explore Pushdown Automata and Turing Machines.
- To introduce undecidability, recursion, and computational complexity

### **Course Outcome:**

After the successful completion of the course, the students will be able to:

- CO1:** Apply set theory and induction to define formal languages.
- CO2:** Construct and analyze regular expressions and finite automata.
- CO3:** Classify languages using grammars and pumping lemmas.
- CO4:** Design PDA and TMs for complex language recognition.
- CO5:** Analyze problems in terms of decidability and complexity classes.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
Basic Mathematical Objects and Mathematical Induction: Sets, logic, Functions, Relations, Alphabets, Strings, Languages, Principle of mathematical induction, Recursive definition, <b>Nyāya and Pāṇini's Grammar as Foundations of Formal Languages and Automata Theory.</b>	5
<b>Unit II</b>	
Regular Expressions and Finite Automata: Regular languages and Regular Expressions, Memory required to recognize a language, Finite Automata, capability & limitations of FSM, Deterministic Finite Automata , Non-Deterministic Finite Automata, NFA with e-moves, regular sets & regular expressions, Equivalence of DFA and NFA, NFA from regular expressions, regular expressions from DFA, Moore versus Mealy m/c, two way finite automata equivalence with one way , Kleen's Theorem, applications of finite automata.	7
<b>Unit III</b>	
Regular and Non-regular languages: Criterion for Regularity, Minimal Finite Automata, Pumping Lemma for Regular Languages, Decision problems, Regular Languages and Computers. Context Free Grammars: Introduction, definition, Regular Grammar, Derivation trees, Ambiguity, Simplified forms and Normal Forms, Applications.	6
<b>Unit IV</b>	
Pushdown Automata: Definition, Moves, Instantaneous Descriptions, Language recognised by PDA, Deterministic PDA, Acceptance by final state & empty stack, Equivalence of PDA , Pumping lemma for CFL, Interaction and Complements of CFL, Decision algorithms. Turing Machines: Definition and examples, Computing Partial Functions with Turing Machine(TM), Combining TMs, Variations of TMs, Multi-tape TMs, Non-deterministic TM, Universal TM, Church Thesis.	7
<b>Unit V</b>	
Recursively Enumerable Languages: Recursively Enumerable and Recursive, Enumerating Language, Context Sensitive and Chomsky Hierarchy. Unsolvability Problems and Computable Functions: Nonrecursive Language and unsolvable Problems, Halting Problem, Rice Theorem, Post Correspondence Problem. Computational Complexity: Discussion on P, NP, NPC and NP-Hard Problems.	5

**Text Books:**

1. Martin John "Introduction to Languages and the Theory of Computation", 3rd Edition, TMH. Reference Books: 1. Mishra K.L.P & Chandrasekharan N., "Theory of Computer Science", PHI.
2. Hopcroft John E. And Ullman Jeffrey D., "Introduction to Automata Theory, Languages & Computation", 3rd Edition, Narosa, 2008.
3. Lewis H. R. and Papadimitrou C. H, "Elements of the theory of Computation", PHI.

**Program:** MCA

**Semester:** Second

**Course:** Software Engineering

**Course Code:** 3CIT108

L	T	P	C
4	0	0	4

---

**Course Objective:**

The objective of this course is:

- To understand software processes and development models.
- To learn requirement engineering techniques.
- To gain knowledge of software design and testing methods.
- To understand metrics, estimation, and configuration management.

**Course Outcome:**

After the successful completion of the course, the students will be able to:

**CO1:** Apply suitable software process models in development.

**CO2:** Document user requirements using engineering tools.

**CO3:** Design and test software for validation and reliability.

**CO4:** Use metrics and estimation for project quality management.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>Introduction to Software Engineering:</b> Evolving Role of Software, Changing Nature of Software, Legacy Software, Process Frame work, Process Patterns, Process Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, Unified Process Model, Agile Process Model, <b>Systematic Approaches to Knowledge: From Shilpa Shastra to Modern Software Process Models.</b>	10
<b>Unit II</b>	
<b>Requirement Engineering:</b> A bridge to design and construction, Requirement Engineering Task, Initiating the Requirement Engineering Process, Eliciting Requirements, Developing Use case, Building the Analysis Model, Negotiating Requirements, Validating Requirements.	10
<b>Unit III</b>	
<b>Design Engineering:</b> Design Process and Design Quality, Design Concepts, Design Models, Pattern Based Software Design. <b>Software Testing:</b> Testing Strategies and Testing Tactics, Strategic Approach to software Testing, Test Strategies for conventional, Validation Testing System Testing, White Box Testing, Basic Path Testing Control Structure Testing, Black Box Testing.	10
<b>Unit IV</b>	
<b>Metric for process and Estimation Techniques:</b> Process metrics, Software Measurement, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Estimation for Object Oriented Projects Specialized Estimation Techniques. Software Quality and Configuration Management: Quality Concepts, Software Quality Assurance, Software Reliability, Software Configuration Management, SCM Repository, SCM Process.	10

**Text Book:**

1. Pressman Roger S., “Software Engineering – A Practitioner’s Approach”, 6th Edition., Tata McGraw Hill.

**Reference Books:**

1. Vliet Haus Van, “Software Engineering – Principles and Practice”, Wiley John and Sons, 2nd Edition.
2. Sommerville Ian, “Software Engineering”, 7th Edition. Pearson Education.

**Program:** MCA

**Semester:** Second

**Course:** Optimization Techniques Linear Programming

**Course Code:** 3CMT102

L	T	P	C
4	0	0	4

---

**Course Objective:**

The objective of this course is:

- To learn linear programming and simplex methods.
- To understand integer programming and queueing theory.
- To study replacement and inventory models.
- To apply PERT and CPM for project management.

**Course Outcomes:**

After the successful completion of the course, the students will be able to:

- CO1:** Solve LPP using simplex, dual, and transport methods.
- CO2:** Apply integer programming and queue models.
- CO3:** Analyze replacement and inventory strategies.
- CO4:** Use PERT/CPM for project planning and control.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
Graphical method for two dimensional problems - Central problem of linear programming various definitions - statements of basic theorems and properties - Phase I and Phase II of the simplex method - revised simplex method - primal and dual - dual simplex method - sensitivity analysis transportation problem and its solution - assignment problem and its solution by Hungarian method, <b>Ancient Indian Approaches to Problem Solving: From Chanakya's Arthaśāstra to Modern Optimization Methods.</b>	10
<b>Unit II</b>	
<b>Integer Programming</b> Gomory cutting plane methods - Branch and Bound method. <b>Queueing Theory</b> Characteristics of queueing systems - steady state MIMIt, MIMIt/K and MIMIC queueing models.	9
<b>Unit III</b>	
<b>Replacement Theory</b> replacement of items that deteriorate - Replacement of items that fail Group replacement and individual replacement. <b>Inventory theory</b> Costs involved in inventory problems - single item deterministic models-economic lot size models without shortages and with shortages having production rate infinite and finite.	10
<b>Unit IV</b>	
<b>PERT and CPM</b> Arrow networks - time estimates- earliest expected time, latest allowable occurrence time and slack - critical path - probability of meeting scheduled date of completion of project – calculations on CPM network - various floats for activities - critical path - updating project - operation time cost trade off curve - project time cost trade off curve - selection of schedule based on cost analysis.	11

(Remarks: No mathematical derivations included).

**References**

1. Gillet, B.E., "Introduction to Operations Research : A Computer Oriented Algorithmic Approach". Tata McGraw Hill, New York, 1990.
2. Gross D., and Harris. C.M .. "Fundamentals of Queueing Theory", John Wiley and Sons, New York. 1980.
3. Hillier F., and Lieberman. GJ., "Introduction to Operations Research", Holden Day, New York. 1985.
4. Karnbo, N.S., "Mathematical Programming Techniques", McGraw Hill, New York. 1985.

5. KantiSwarup, Gupta, P.K., and Man Mohan, "Operations Research", Sultan Chand & Sons. New Delhi. 1990.
6. Mital K. V., "Optimization Methods In Operations Research and System Analysis", New Age International (P) Ltd., New Delhi, 1992.
7. Saffer, L.R., Fitter J.B., and MeyerW.L., "The Critical Path Method". McGraw Hill. New York. 1990.
8. Taha, H.A., "Operations research- An Introduction", McMillan Publishing co .• New York, 1986.

**Program:** MCA

**Semester:** Second

**Course:** Computer Graphics

**Course Code:** 3CITE202

L	T	P	C
3	0	0	3

---

### **Course Objective:**

The objective of this course is:

- To introduce the fundamentals and applications of computer graphics and graphics systems.
- To develop understanding of 2D graphics algorithms and geometric transformations.
- To study viewing transformations and clipping techniques in 2D graphics.
- To understand 3D geometric transformations and viewing pipelines.

### **Course Outcomes:**

After the successful completion of the course, the students will be able to:

**CO1:** Describe the basics of computer graphics and different display technologies.

**CO2:** Implement 2D drawing and geometric transformation algorithms using matrix operations.

**CO3:** Apply various clipping algorithms for 2D viewing and graphics rendering.

**CO4:** Perform 3D transformations and explain viewing and projection techniques.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>Introduction:</b> Computer Graphics and their applications. Overview of Graphics system. Display Devices: CRT Monitors (Random – Scan and Raster Scan, DVST, Plasma – Panel Display, LED and LCD Monitors. Graphics Software.	6
<b>Unit II</b>	
<b>Elementary Drawing:</b> Points and various line drawing Algorithms and their comparisons efficiency contact. Cycle generating algorithms Other objects like ellipses, arcs, section spirits. Two Dimensional Geometric Transformations: Basic Transformations, Matrix Representations and Homogeneous coordinates, Composite Transformations, Reflection and Shear, Transformations between Coordinates Systems, Raster Methods for Transformations.	9
<b>Unit III</b>	
<b>Two Dimensional Viewing:</b> The Viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-View Port Coordinate Transformation, Clipping-Point, Line(Cohan-OSutherland Line Clipping and Liang –Barsky Line Clipping and Nicholl-Lee-Nicholl Line Clipping) and Polygon Clipping(Sutherland-Hodgeman Polygon Clipping, Weiler-Atherton Polygon Clipping).	9
<b>Unit IV</b>	
<b>Three Dimensional Geometric Transformations:</b> Translation, Rotation, Scaling, Reflection and Shears, Composite Transformations, Modeling and Coordinate Transformations. Three Dimensional Viewing: Viewing Pipeline, Viewing Coordinates, Projections and Clipping.	6

**References:**

1. Computer Graphics by Donal Hearn M. Pardive Baker (PHI) Easter Economy Edition.
2. Computer Graphics by Roy A. Plastockand Gordon Kalley – Schaum’s Series.
3. Computer Graphics by Marc Berger.
4. J. F. KoegelBuferd -Multimedia Systems, Pearson Education, New Delhi,
5. J.D.Foley- Computer Graphics, 2ndEdn, Pearson Education, New Delhi,

**Program:** MCA

**Semester:** Second

**Course:** Computer Graphics lab

**Course Code:** 3CITE202P

L	T	P	C
0	0	2	1

---

### **Course Objectives:**

The objective of this course is:

- To enable students to understand and apply basic graphical functions for drawing 2D shapes and images.
- To develop programming skills to implement various graphical elements like charts, faces, vehicles, and animation effects.
- To teach line and circle drawing algorithms such as DDA and Bresenham's methods.
- To introduce fundamental 2D and 3D transformations, clipping, and animation techniques.

### **Course Outcomes:**

After the successful completion of the course, the students will be able to:

- CO1:** Write programs to draw and manipulate basic 2D shapes using computer graphics libraries.
- CO2:** Create visual outputs - charts, smiley faces, and animated scenes through graphical programming.
- CO3:** Implement and demonstrate standard line and circle drawing algorithms - DDA and Bresenham's algorithms.
- CO4:** Apply 2D and 3D transformations, clipping, and animation techniques to graphical objects in practical scenarios.

**Course Content:**

1. Write a program to draw a point.
2. Write a program to draw line
3. Write a program to draw a circle.
4. Write a program to draw a rectangle
5. Write a program to draw a sector
6. Write a program to draw an ellipse
7. Write a program to draw an arc.
8. Write a program to draw smiley face
9. Write a program to draw a polygon
10. Write a program to draw a filled polygon.
11. Write a program to draw a concentric circle.
12. Write a program to draw a kite
13. Write a program to draw pie slice
14. Write a program to draw a bar
15. Write a program to draw a 3D bar
16. Write a program to draw pie chart
17. Write a program to draw bar chart
18. Write a program to draw 3D Bar chart
19. Write a program to draw a digital clock
20. Write a program to draw a car.
21. Write a program to draw a moving car
22. Write a program to draw a half filled glass with blue water
23. Write a program to explain DDA Line Drawing algorithm.
24. Write a program to explain Bresenham's Line Drawing algorithm
25. Write a program to explain Bresenham's Circle Drawing algorithm.
26. Write a program to explain :
  - Text Animation
  - 2D Rotation, Translation, Scaling
  - 3D Rotation, Translation, Scaling
  - Line Clipping

**Program:** MCA

**Semester:** Second

**Course:** Professional Skills

**Course Code:** 3CHSMC102

L	T	P	C
2	0	0	2

---

**Course Objective:**

The objective of this course is:

- Understand the pivotal role of effective communication in achieving personal and professional success.
- Develop and apply appropriate communication strategies for various contexts, including message preparation and presentation.
- Analyze diverse communication acts and ethically integrate documented sources.
- Cultivate essential soft skills for overall personality development and enhanced professional and interpersonal communication.

**Course Outcomes:**

After the successful completion of the course, the students will be able to:

**CO1:** Identify and coordinate life and professional goals.

**CO2:** Learn self-improvement through interpersonal skills.

**CO3:** Apply solutions to challenges.

**CO4:** Adapt to changes and manage life and work balance

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>Personal Development Managing Self :-</b> Self Discovery, Self-Awareness, Self Esteem, Self-Responsibility, Self-Management ,Personal Development Skills, Categories of Personal Development, Personal Development Process ,Relationship Management - Managing Others, Interpersonal Skills, Improving ,Relationship, Transactional Analysis, JOHARI Window, four Life Positions, <b>Dialogue Traditions of India: From Shastrartha to Modern Professional Communication.”</b>	6
<b>Unit II</b>	
<b>Thinking Process:-</b> Strategic Thinking – Introduction, Concept, Stages in Strategic Thinking, Process of Strategic Thinking, Importance of Strategic Thinking, Characteristics of Strategic Thinkers, Developing Strategic Thinking ,Lateral Thinking – Introduction, Meaning, Need for Lateral Thinking, Techniques of Lateral Thinking, Benefits of Lateral Thinking ,Creative Thinking – Out of Box Thinking, Application of Thinking ,Facing Changes – Adapting Change, Understanding Change- Examples of Organizational Change , Facing Challenges – Introduction, Taking Initiative, Benefits of facing challenges, Facing challenges in life ,Balancing Work and Life – Importance, Gender differences regarding work life balance, Tips for balancing work and life	6
<b>Unit III</b>	
<b>Individual Behavior:-</b> Attitude – Components of Attitude, Factors influencing Attitude, Types of Attitude, Challenges and lessons from Attitude, Impact of Attitude on Behavior , Motivation – Concept, Objective, Factors of Motivation, Self-esteem, Intrinsic & Extrinsic Motivation ,Time Management – Value of Time, Diagnosing Time management, Weekly Planner, To Do List, Prioritizing Work ,Stress Management – Introduction, Difference between Stress, Anxiety and Tension, Managing Stress ,Applied Ethics – Introducing Professional Ethics, Ethical Dilemma	6
<b>Unit IV</b>	
<b>Employment Communication:</b> Job Communication – Developing Job Communication Skills, Job Communication Process, Developing Confidence ,Job Search Strategy – Understanding the Job Market, The Job Search Process, Job Search Techniques ,Job Application, Employment Letters ,Resume Building – Difference between Bio data, Curriculum Vitae and Resume ,The Job Interview - Types of Job Interview, Preparing for a Job Interview, Understanding Interview Questions, Handling Interview Questions, Interview Strategies ,Psychometric Test	6

**Suggested Readings:**

1. Covey S (2004) The 7 Habits of Highly Effective People.
2. Goud, N. & Arkoff, A. (2003) Psychology and Personal Growth, Allyn & Bacon.
3. Sen, Leena, Communication Skills, Eastern Economy Edition
4. Dr.K.Alex Managerial Skills, S.Chand

**Program:** MCA

**Semester:** Second

**Course:** Character Building & Holistic  
Development of Personality II

**Course Code:** 3CMVAC102

L	T	P	C
2	0	0	2

---

**Course Learning Objective:**

The objective of this course is:

- Create awareness among students about Pranamaya Kosha and Manomaya Kosha.
- Make students acquainted with Indian cultural values and motivate them for protection and conservation of values.
- Generate awareness about different asanas through yoga among students.
- Prepare the students to develop psychosocial competency.

**Course Outcome:**

On completion of the Course, the students will be able to:

**CO1:** Understand Pranamaya Kosha and Manomaya Kosha.

**CO2:** Analyze the concept of character building and personality development within human, societal, and national contexts.

**CO3:** Connect the importance of physical development through asana in one's life.

**CO4:** Become self-reliant and manage their behavioral aspects.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>Cognitive Development:</b> Pranamaya Kosha - General Introduction, Concept and its Requirement. Prana's four impulses- Aahaar, Nidra, Bhay (Fear] and Maithun. The development of Prana-Shakti and its relation to body and mind, Efforts for the development of Pranas Imbalance in Pranas and its side effects. Manomaya Kosha - General Introduction, Concept and its Requirement. Manomaya Kosha as the operator of the body, Peace, concentration, detachment, positivity. Process of development of Mana, Activities and programmes for development of Mana, <b>Prāṇamaya and Manomaya Kosha: Ancient Indian Insights into Psychosocial Well-Being and Human Development.</b>	8
<b>Unit II</b>	
<b>Moral Spiritual Development:</b> Contribution of great Indian Personalities in the process of Character-Building and Personality Development (especially in the context of Human, Society and Nation building). Veer Shivaji, Guru Gobind Singh, Swami Dayananda Saraswati, Savitri Bai Phule and Ravindra Nath Tagore.	4
<b>Unit III</b>	
<b>Physical Development:</b> Asana- (Asanas in sitting position) Singhasana, Padmasana Vajrasana, Matsyasana, Gomukhasana and Parvatasana. Pranayama- Chandra Bhedan, Surya Bhedan and Udgeeth. Hasta Mudra - Surya Mudra and Prana Mudra.	8
<b>Unit IV</b>	
<b>Intellectual – Emotional Development:</b> Scientific Approach, Non-violence, Self-Confidence. Student: The future of the nation, love, Ideal Friend, Student Life and Benevolence, and Spirit of Nationality.	4

**Suggested Reading:**

1. Light on Yoga, B.K.S.Iyengar – Thorsons, London
2. SavitriPhule, Prof. GopuSudhakar, Raj Prakashnan, Delhi
3. Ravindranath Tagore : An Interpretation, Sabyasachi Bhattacharya, Penguin , Delhi

# **Semester III**



SEMESTER III												
S. No	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject	Credit
				L	T	P	Assignment	T A	Total	E S E	Total	
1	Information Technology Core	3CIT201	Artificial Intelligence	3	0	0	20	10	30	70	100	3
2	Information Technology Core	3CIT202	Data Mining and Warehousing	4	0	0	20	10	30	70	100	4
3	Information Technology Core	3CIT203	Python Programming	3	0	0	20	10	30	70	150	3
4	Departmental Elective II			3	0	2	20	10	30	70	100	4
5	Value Added	3CMVAC201	Character Building & Holistic Development of Personality-III	2	0	0	20	10	30	70	100	2
PRACTICAL /SESSIONAL												
1	Information Technology Core	3CIT201P	Artificial Intelligence Lab	0	0	4			30	20	50	2
2	Information Technology Core	3CIT203P	Python Programming Lab	0	0	4			30	20	50	2
3	Project	3CPROJ201	Project-I	0	0	8			100	100	200	4
									<b>TOTAL</b>	<b>750</b>	<b>24</b>	

**Program:** MCA

**Semester:** Third

**Course:** Artificial Intelligence

**Course Code:** 3CIT201

L	T	P	C
3	0	0	3

---

### **Course Objectives:**

The objective of this course is:

- To understand the scope of AI and basic search strategies.
- To learn knowledge representation and reasoning techniques.
- To handle uncertainty using probabilistic and fuzzy methods.
- To explore machine learning and expert systems with applications.

### **Course Outcomes:**

After the successful completion of the course, the students will be able to:

- CO1:** Apply search algorithms like DFS, BFS, and game-tree search.
- CO2:** Use logic and rule-based systems for knowledge representation.
- CO3:** Implement uncertainty handling using probabilistic and fuzzy logic.
- CO4:** Explain machine learning and expert systems like MYCIN and RI.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<p><b>Scope of AI</b> Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction.</p> <p><b>Problem solving</b> State space search: Production systems. Search space control: Depth first, breadth first search, heuristic search - Hill climbing, best first search, branch and bound. Minimax search: Alpha-Beta cut offs, <b>Indian Logic Systems (Nyāya, Tarka, and Anvikṣikī): Early Foundations of Reasoning and Knowledge Representation in AI.</b></p>	10
<b>Unit II</b>	
<p><b>Knowledge Representation</b> Predicate Logic: Skolemizing queries, Unification. Modus ponens. Resolution, dependency directed backtracking. Rule Based Systems: Forward reasoning: Conflict resolution. Backward reasoning: Use of no backtrack. Structured Knowledge Representations: Semantic Net: slots, exceptions and defaults Frames</p>	12
<b>Unit III</b>	
<p><b>Handling uncertainty</b> Probabilistic reasoning. Use of certainty factors. Fuzzy logic.</p>	6
<b>Unit IV</b>	
<p><b>Learning</b> Concept of learning, learning automation, genetic algorithm, learning by induction, neural nets back propagation. <b>Expert Systems</b> Need and justification for expert systems. Knowledge acquisition. Case studies: MYCIN, RI.</p>	12

**References**

1. Nilsson, N.J., "Principles of AP", Narosa Publishing House, 1990.
2. Patterson, D. W., "Introduction to AI and Expert Systems", Prentice Hall of India, 1992.
3. Peter Jackson, "Introduction to Expert Systems", Addison Wesley Publishing Company, M.A., 1992.
4. Rich, E., and Knight, K., "Artificial Intelligence", Tata McGraw Hill (2nd Edition), 1992.
5. Schalk off, R.J., "Artificial Intelligence • An Engineering Approach", McGraw Hill International Edition, Singapore, 1992.
6. Sasikumar, M., Ramani, S., "Rule Based Expert System", Narosa Publishing House, 1994.

**Program:** MCA

**Semester:** Third

**Course:** Artificial Intelligence Lab

**Course Code:** 3CIT201P

L	T	P	C
0	0	4	2

---

### Course Objectives:

The objective of this course is:

- To understand basic Python syntax and structure.
- To solve problems using arithmetic, logical, and looping operations.
- To work with lists and strings for data handling.
- To implement graph algorithms using Python.

### Course Outcomes:

After the successful completion of the course, the students will be able to:

- CO1:** Write basic Python programs using I/O, variables, and control structures.
- CO2:** Solve mathematical problems using Python constructs.
- CO3:** Use lists and strings for data manipulation in Python.
- CO4:** Implement BFS, shortest path, and cycle detection algorithms using Python.

**Course Content:**

**List of experiments:**

1. Python program to print your name.
2. Python program to find area of a circle.
3. Python program to check whether a number is even or not.
4. Python program to find factorial of a given number.
5. Python program for n-th Fibonacci series.
6. Python program to print all positive numbers in a range.
7. Python program to print ASCII value of a character.
8. Python program to print sum of n numbers.
9. Python program to find largest number in a list.
10. Python program to print even numbers in a list.
11. Python program to remove i'th character from string in Python.
12. Python program to implement graph.
13. Python program to implement BFS on graph.
14. Python Program to Find Shortest Path from a Vertex using BFS in an Unweight Graph.
15. Python Program to find if Directed Graph contains Cycle using DFS

**Program:** MCA

**Semester:** Third

**Course:** Data Mining and Warehousing

**Course Code:** 3CIT202

L	T	P	C
4	0	0	4

---

**Course Objectives:**

The objective of this course is:

- To understand data mining concepts and data pre-processing.
- To learn data warehouse design and architecture.
- To apply association rule mining techniques.
- To study classification and prediction models.

**Course Outcomes:**

After the successful completion of the course, the students will be able to:

- CO1:** Explain data mining functionalities and pre-processing methods.
- CO2:** Build and implement data warehouse systems.
- CO3:** Extract patterns using association rule mining.
- CO4:** Apply classification and prediction techniques effectively.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
Data Mining: Introduction, Relational Databases, Data Warehouses, Transactional databases, Advanced database Systems and Application, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining. Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, <b>From Ancient Granthas to Knowledge Warehousing: Indian Traditions of Information Classification and Pattern Discovery.</b>	10
<b>Unit II</b>	
Data Warehouse: Introduction, A Multidimensional data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization	9
<b>Unit III</b>	
Mining Association Rules in Large Databases: Association Rule Mining, Single – Dimensional Boolean Association Rules, Multilevel Association Rules from Transaction Databases, Multi-Dimensional Association Rules from Relational Databases, From Association Mining to Correlation Analysis.	11
<b>Unit IV</b>	
Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification based on concepts & Association Rule Analysis, Other Classification Methods, Prediction, Classification Accuracy.	10

**Text books:**

1. Jiawei Han & Micheline Kamber “Data Mining Concepts & Techniques”, Publisher Harcourt India. Private Limited, 2<sup>nd</sup> Edition.

**Reference books:**

1. Gupta G.K. “Introduction to Data Mining with case Studies”, PHI, New Delhi, 2006.
2. Berson A. & Smith S.J. “Data Warehousing Data Mining”, COLAP, TMH, New Delhi, 2004.
3. Dunham H.M. & Sridhar S. “Data Mining”, Pearson Education, New Delhi, 2006.

**Program:** MCA

**Semester:** Third

**Course:** Python Programming

**Course Code:** 3CIT203

L	T	P	C
3	0	0	3

---

### **Course Objective:**

The objective of this course is:

- To introduce the basics of Python programming including data types, operators, and built-in functions.
- To familiarize students with file handling and persistent storage in Python.
- To develop skills in managing exceptions and using modular programming techniques.
- To explore regular expressions and multithreading concepts in Python.
- To enable students to perform basic database programming using Python's DB-API and ORM.

### **Course Outcome:**

After the successful completion of the course, the students will be able to:

**CO1:** Understand and apply Python data types, objects, and operators.

**CO2:** Perform file input/output operations using Python built-in functions and modules.

**CO3:** Implement exception handling and modularize code using Python modules and packages.

**CO4:** Use regular expressions and multithreading for advanced programming tasks.

**CO5:** Connect and interact with databases using Python's DB-API and ORM tools.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
Python Basics, Objects-Python Objects, Standard Types, Other built-in Function, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the standard types, Unsupported types. Numbers – Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Function, Related Modules. Sequences – strings, Lists, and Tuples, Mapping and Set types, <b>Algorithmic Thinking in Indian Mathematics: From Pingala’s Chandas Shastra to Modern Programming Practices.</b>	7
<b>Unit II</b>	
Files: File objects, File built in Function [open () ], File Built in Methods, File Built-in Attributes, Standard Files, Command – line Arguments, File system, File Execution, persistentStorage Modules, Related Modules.	7
<b>Unit III</b>	
Exceptions: Exceptions in Python, Detecting and handling Exceptions, Context Management, Exceptions as Strings, Raising Exception, Assertions, Standard Exception, Creating Exceptions, Why Exceptions (Now?) , Why exception at all?, Exceptions and the sys Module, Related Modules. Modules: Modules and files, Namespaces, Importing Modules Attributes, Module Built-in Functions, Packages, Other Features of Modules.	6
<b>Unit IV</b>	
Regular Expressions: Introduction, Special Symbols and Characters, Res and Python Multithreaded Programming: Introduction, Threads and processes, Python, Threads, The global Interpreter Lock, Thread Module, Threading Module, Related Modules.	5
<b>Unit V</b>	
Database Programming: Introduction, Python Database Application Programmers Interface, (DB-API), Object Relational managers (ORMs), Related Modules.	5

**Suggested Readings:**

- 1. Core Python Programming**, Wesley J. Chun. Second Edition, Pearson.
- Wesley J Chun, “**Core Python Applications Programming**”, 3rd Edition, Pearson Education India. 2015, ISBM-13: 978-9332555365

**Program:** MCA

**Semester:** Third

**Course:** Python Programming lab

**Course Code:** 3CIT203P

L	T	P	C
0	0	4	2

---

### Course Objectives:

The objective of this course is:

- To introduce basic programming concepts using Python.
- To develop skills in writing control structures such as loops and conditionals.
- To enable students to apply functions and data structures for problem-solving.
- To familiarize students with file handling and string operations in Python.
- To solve real-life mathematical and logical problems through hands-on Python programs.

### Course Outcomes:

After the successful completion of the course, the students will be able to:

- CO1:** Write and execute simple Python programs using input/output and expressions.
- CO2:** Use loops, conditional statements, and functions effectively in problem-solving.
- CO3:** Apply lists, dictionaries, and string operations in various applications.
- CO4:** Perform file operations and handle structured data using Python.
- CO5:** Develop and test Python programs to solve basic mathematical and logical tasks.

### List of Programs:

1. Program to print “Hello” five times.
2. Write a program to convert fahrenheit to celcius
3. Write a Program for checking whether the given number is a even number or not.
4. Write a program add that takes 2 numbers as command line arguments and prints its sum.
5. Using a for loop, write a program that prints out the decimal equivalents of  $1/2$ ,  $1/3$ ,  $1/4$ , . . . ,  $1/10$ .
6. Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)
7. Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.
8. Write a program using for loop that loops over a sequence.
9. Write a program using a while loop that asks the user for a number, and prints a countdown from that number.
10. Write a program to count the numbers of characters in the string and store them in a dictionary data structure.
11. Write a program to perform addition of two square matrices
12. Write a program to perform multiplication of two square matrices.
13. Find mean, median, mode for the given set of numbers in a list.
14. Write a function unique to find all the unique elements of a list.
15. Write a function dups to find all duplicates in the list.
16. Write function to compute gcd, lcm of two numbers
17. Find mean, median, mode for the given set of numbers in a list.
18. Write a program to perform multiplication of two square matrices.
19. Write a program to print each line of a file in reverse order.
20. Write a program to compute the number of characters, words and lines in a file.
21. Write a function ball\_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls If (distance between two balls centers)  $\leq$  (sum of their radii) then (they are colliding)

### Reference Books:

1. Allen B. Downey , “ Think Python: How to Think Like a Computer Scientist”, Second Edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016.
2. Shroff “Learning Python: Powerful Object-Oriented Programming; Fifth edition, 2013.
3. David M.Baezly “Python Essential Reference”. Addison-Wesley Professional; Fourth edition, 2009. 4. David M. Baezly “Python Cookbook” O’Reilly Media; Third edition, 2013.

**Program:** MCA

**Semester:** Third

**Course:** Compiler Design

**Course Code:** 3CITE305

L	T	P	C
3	0	0	3

---

### **Course Objective:**

The objective of this course is:

- To introduce the concepts, phases, and tools involved in the construction of a compiler.
- To understand lexical and syntax analysis using tools like LEX and YACC.
- To study syntax-directed translation and intermediate code generation techniques.
- To learn optimization techniques for efficient machine-independent code generation.
- To explore runtime environments, memory management, and final code generation strategies.

### **Course Outcome:**

After the successful completion of the course, the students will be able to:

- CO1:** Explain the phases and structure of a compiler and its construction tools.
- CO2:** Design lexical and syntax analyzers using LEX and YACC tools.
- CO3:** Construct syntax trees and generate intermediate code using attribute grammars.
- CO4:** Apply optimization techniques to enhance the efficiency of generated code.
- CO5:** Implement runtime memory management and generate target machine code.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<p><b>Introduction to Compiling:</b> Translators, Interpreters, Compiler, other language processors, Phases of a compiler, Passes of compiler, Back-end and Front-end of compiler, Basic idea on Symbol Table, Issues in Compiler construction, Concept on l-value and r-value, Programming Language basics, Compiler construction tools.</p> <p><b>Lexical and Syntax Analysis:</b> <i>Lexical analysis:</i> Role of a Lexical analyser, Input buffering, Specification and recognition of tokens, State-machine driven lexical analysers and their implementations, Lexical analyser generator tool: LEX/FLEX,</p> <p><b>From Pāṇini's Ashtādhyāyī to Modern Compilers: Rule-Based Systems, Grammar Formalization, and Language Processing in Indian Knowledge Traditions</b></p>	7
<b>Unit II</b>	
<p><b>Syntax analysis:</b> Need and Role of Parser, Importance of Context Free Grammars in designing Parser, Parse trees, derivations and sentential forms, Ambiguity.</p> <p><b>Top down parsing:</b> Backtracking, Recursive descent and Predictive parsers (LL), Error-detection in LL parser</p> <p><b>Bottom-up parsing:</b> Simple Shift-Reduce parsing, LR Parsers: SLR, CLR and LALR parsers, Error detection in S-R parsing, handling ambiguous grammar, Parser generator tool: YACC/BISON</p>	7
<b>Unit III</b>	
<p><b>Syntax Directed Translation:</b> Syntax directed definitions, Construction of syntax tree, Attribute grammars, Inherited and synthesized attributes, Dependency graphs, Evaluation orders of attributes, S-Attributed definitions, L-attributed definitions.</p> <p><b>Intermediate code generation:</b> Variants of Syntax Trees, Three-address codes of different constructs, Translation of expressions, Type checking: Rules for type checking, Type conversion.</p>	6
<b>Unit IV</b>	
<p><b>Machine independent code optimization:</b> Sources of optimization, DAG, Peephole optimization and Basic Blocks, Loops in Flow Graphs, Data flow analysis and equations.</p>	5
<b>Unit V</b>	
<p><b>Runtime Environment and Code Generation:</b></p> <p><b>Runtime environment:</b> Storage organization: Static and Dynamic, Stack allocation and Heap allocation of memory;</p> <p><b>Code generation:</b> Issues in designing of a code generator, Register allocation and Assignment, Target machine (assembly code for 80- series)</p>	5

## References

2. Levine John R., Mason Tony, Brown Doug “Lex & Yacc”, O’reilly.
3. Appel Andrew N., “Modern Compiler Implementation in C”, Cambridge University Press.
4. Cooper & Linda “Engineering a Compiler”, Elsevier theory. Whitten. Bentley and Barlow. "System Analysis and Design Methods". Second Edition. Galgotia Publications. 1996.

**Program:** MCA

**Semester:** Third

**Course:** Compiler Design Lab

**Course Code:** 3CITE305P

L	T	P	C
0	0	2	1

---

### Course Objectives:

The objective of this course is:

- To develop basic programming skills for file handling and string pattern recognition using C.
- To design and simulate finite automata to recognize language tokens and patterns.
- To introduce lexical analysis using Lex for token recognition in C programs.
- To construct syntax parsers using YACC for context-free grammars and expressions.
- To implement translators and calculators using infix, prefix, and postfix notation parsing.

### Course Outcomes:

After the successful completion of the course, the students will be able to:

- CO1:** Write C programs for string analysis, pattern matching, and file-based input parsing.
- CO2:** Simulate finite automata in C for identifying tokens like identifiers and constants.
- CO3:** Use Lex for designing lexical analyzers that detect valid tokens in C code.
- CO4:** Build YACC-based parsers for context-free languages and arithmetic expressions.
- CO5:** Develop simple compilers and interpreters for expression translation and evaluation.

**List of experiments:**

1. C program to count white spaces, numbers, words in a file.
2. C program to design Finite automata to identify different tokens (identifiers, constants, operators, etc.).
3. C program to count number of a's in given string.
4. C program to Identify different patterns like aa, ab, not containing a, etc. in given string.
5. Lex program to identify all tokens of C programs.
6. Design and Code individual programming code with all possible tokens in programming
7. Starting and ending with 'a'.
8. # a's divisible by 2 or b's divisible by 3.
9. 4<sup>th</sup> Symbol 'a' from RHS.
10. Output code after removing white spaces and comment.
11. Build parsers using YACC for  $L(G) = \{anbn \mid n \geq 1\}$  over  $\{a,b\}$
12. Build Parser using YACC for  $L(G)$  where rule set of  $G$  is  $\{ S \rightarrow aSb, S \rightarrow bSa, S \rightarrow c \}$  over  $\{a,b,c\}$ .
13. Build parser using YACC to convert the infix expression to postfix expression.
14. Build a calculator in YACC which takes expression in postfix notation.
15. Build parsers using YACC to convert the prefix expression into the postfix expression.

**Program:** MCA

**Semester:** Third

**Course:** Internet and Website Management

**Course Code:** 3CITE301

L	T	P	C
4	0	0	4

---

**Course Objective:**

The objective of this course is:

- To introduce the fundamentals of the Internet, domains, connectivity, and web clients.
- To teach students the structure and usage of HTML for designing web pages.
- To develop skills in using JavaScript for dynamic content and basic client-side scripting.
- To familiarize students with XML, JSP, and tools for creating dynamic, structured web content.

**Course Outcomes:**

After the successful completion of the course, the students will be able to:

- CO1:** Understand Internet basics, domain registration, IP addressing, and browser functions.
- CO2:** Design structured static web pages using HTML elements
- CO3:** Apply JavaScript to create interactive web content using variables, functions, and control structures.
- CO4:** Differentiate between XML and HTML and build dynamic web pages using JSP and XML technologies.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
Internet Basics: Basic concepts, Communication on the Internet, Internet Domains, Using Web Browsers, Internet Server Identities, Establishing Connectivity on the Internet, Client IP Address, Web Client, Domain Registration, <b>From Ancient Indian Communication Networks to the World Wide Web: Evolution of Knowledge Sharing and Structured Information Systems.</b>	8
<b>Unit II</b>	
Introduction to HTML: HTML, HTML Editors, HTML Tags, Commonly Used HTML Commands, Title and Footers, Heading, paragraphs, comments Text Formatting, TextStyle, Lists, Types of list: ordered list, unordered list, Adding Graphics to HTML Documents, Tables, Attributes of Table: row span, call span, Table with heading and images, Linking Documents, Frames.	10
<b>Unit III</b>	
Java Script : Java Script in Web Pages, Advantages of Java Script, Data Types and Literals, Type Casting , Java Script Array, Operators and Expression, Conditional Checking , Function, User Line Clipping Defined Function.	11
<b>Unit IV</b>	
XML: Introduction, Difference between XML and HTML, Modeling XML Data, Document Type Definition (DTD),XMLtree,Styling XML with XSL, XHTML Creation of Dynamic Web pages using Java Server Pages (JSP): Dynamic Web Page, Introduction of JSP, Pages Overview, JSP Scripting, Standard Action, Page Directive, Include Directive.	11

**Suggested Readings:**

1. Ivan Bay Ross- Web Enable Commercial Application Using HTML, DHTML, BPB Publication.
2. Michel Morrison -HTML and XML for Beginners, PHI, New Delhi.
3. H.M Dietal and P.J Dietal -Java How to Program, PHI, New Delhi.

**Program:** MCA

**Semester:** Third

**Course:** Basics of Machine Learning

**Course Code:** 3CITE304

L	T	P	C
4	0	0	4

---

**Course Objective:**

The objective of this course is:

- To learn basics of Machine Learning and linear algebra.
- To understand supervised learning methods like regression and classification.
- To explore advanced models: SVM, decision trees, neural networks.
- To study unsupervised and semi-supervised learning with real-world applications.

**Course Outcome:**

After the successful completion of the course, the students will be able to:

**CO1:** Apply linear algebra techniques and Principal Component Analysis (PCA) in machine learning applications.

**CO2:** Implement regression and classification algorithms for supervised learning tasks.

**CO3:** Design and develop machine learning models using SVM, decision trees, and neural networks.

**CO4:** Apply clustering and semi-supervised learning methods to real-world problems.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>Introduction to Machine Learning</b> Machine Learning – what and why? Supervised learning and unsupervised learning. Basics of Linear Algebra - matrices and vectors, Eigen value decomposition, principal component analysis, <b>From Ancient Indian Pattern Recognition in Chandas and Ayurveda to Modern Machine Learning</b>	8
<b>Unit II</b>	
<b>Supervised Learning</b> Linear Regression with one variable, cost function, gradient descent for linear regression. Linear regression with multiple variables, normal equation, gradient descent. Logistic regression, cost function, gradient descent. Regularization - the problem of overfitting, regularization in linear regression and logistic regression.	9
<b>Unit III</b>	
Dimensionality reduction- Principal components. Decision Tree, Overfitting and Pruning, Support Vector Machine and Kernel; Noise, bias-variance trade-off, under-fitting and over-fitting concepts.	9
<b>Unit IV</b>	
Neural Networks representations, forward propagation, multi class classification. neural networks cost function, backpropagation algorithm. Regularization and bias/ variance. Recurrent networks.	6
<b>Unit V</b>	
<b>Unsupervised and Semi Supervised Learning</b> Clustering - K-means partitional clustering, choosing the number of clusters. Hierarchical Agglomerative Clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabeled data. Brief introduction to ML applications in computer vision, speech and natural language processing, etc	8

**Text Books:**

1. Mitchell Tom, “Machine Learning”, Latest Edition, Mc-Graw Hill.

**Reference Books:**

1. Shwartz Shai Shalev, and David Shai Ben, “Understanding Machine Learning”, Cambridge University Press, 2017.
2. Bishop Christopher “Pattern Recognition and Machine Learning”, Springer, 2006.
3. A Course in Machine Learning by Hal Daumé III (freely available online)

**Program:** MCA

**Semester:** Third

**Course:** Project II

**Course Code:** 3CPROJ201

L	T	P	C
0	0	8	4

---

The knowledge gained in previous courses are to be applied to a practical problem in various disciplines.

- Demonstrate their ability to work independently and collaboratively.
- Develop their abilities in problem solving and critical judgment.
- Demonstrate their ability to effectively collect, analyze and organize scientific information.
- Acquire written and verbal communication skills that allow them to communicate a convincing and reasoned
- Scientific argument at a level and style appropriate to the audience.
- Contribute to group discussions on career preparedness and ethical and professional practice.

**Program:** MCA

**Semester:** Third

**Course:** Character Building & Holistic

Development of Personality III

**Course Code:** 3CMVAC201

L	T	P	C
2	0	0	2

---

**Course Objective:**

The objective of this course is:

- Create awareness among students about Vigyanmaya Kosha and its requirement.
- Make students acquainted with contribution of great Indian Personalities.
- Generate awareness about different asanas through yoga among students.
- Introduce the students to the fundamental principles of national unity and integration and also to sensitize the students regarding gender equality.

**Course Outcome:**

On completion of the Course, the students will be able to:

**CO1:** Understand Vigyanmaya Kosha and its significance.

**CO2:** Analyze character building and personality development in the context of individuals, society, and nation-building.

**CO3:** Connect the importance of physical development through asana in one's life.

**CO4:** Foster a sense of nationality and comprehend the importance of gender equality.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>Cognitive Development:</b> Vigyanmaya Kosha - General Introduction, Concept and its requirement. The specific work of intelligence: as development of capacity of decision making and discretion among students. Activities: To make students enlightened and prudent, to develop leadership qualities, experimental capabilities, research and scientific aptitude among students, <b>Vijñānamaya Kosha: Integrating Ancient Insights into Intellectual and Analytical Growth</b>	6
<b>Unit II</b>	
<b>Moral Spiritual Development:</b> Contribution of great Indian Personalities in the process of Character-Building and Personality Development (especially in the context of Human, Society and Nation building). Swami Vivekananda, Bhagini Nivedita, Mahatma Gandhi, Maharishi Arvinda and Sardar Vallabhbhai Patel.	4
<b>Unit III</b>	
<b>Physical Development:</b> Asana- (Asanas in lying position on the back) Halasana, Sarvangasana, Pawan-Muktasanana, Naukasana, Shavasana and Viprit-Karni. Pranayama-Nadi Shodhan, Shitali and Agnisara. Hasta Mudra - Prithvi Mudra and Agni Mudra.	8
<b>Unit IV</b>	
<b>Intellectual – Emotional Development:</b> Sarva-Pantha Samman, Ideal Education, Patience, Swadeshi, Gender Equality, Social Unity, Environment Protection and Pride of Mother Language.	6

**Suggested Reading:**

1. Light on Yoga, B.K.S.Iyengar – Thorsons, London
2. Gandhian World Order – Dr. Kuldeep Kumar, Nirmal Publication, Kurukshetra

# **Semester IV**



SEMESTER IV												
S. No.	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Assignment	T A	Total	E S E		
<b>PRACTICAL /SESSIONAL</b>												
1	Project	3CPROJ202	Project-II	0	0	40			600	200	800	20
2	Value Added	3CMVAC202	Character Building & Holistic Development of Personality-IV	2	0	0						2
3	University Mandatory Course	3CMUMC101	Managing Personal Finance##	2	0	0						0
									<b>TOTAL</b>			<b>22</b>

**Program:** MCA

**Semester:** Fourth

**Course:** Project II

**Course Code:** 3CPROJ202

L	T	P	C
0	0	40	20

---

The knowledge gained in previous courses are to be applied to a practical problem in various disciplines.

- Demonstrate their ability to work independently and collaboratively.
- Develop their abilities in problem solving and critical judgment.
- Demonstrate their ability to effectively collect, analyze and organize scientific information.
- Acquire written and verbal communication skills that allow them to communicate a convincing and reasoned
- Scientific argument at a level and style appropriate to the audience.
- Contribute to group discussions on career preparedness and ethical and professional practice.

**Program:** MCA

**Semester:** Fourth

**Course:** Character Building & Holistic

Development of Personality IV

**Course Code:** 3CMVAC202

L	T	P	C
2	0	0	2

---

### Course Objective:

The objective of this course is:

- Create awareness among students about Anandamaya Kosha and its requirement.
- Convert students into ideal personalities by inculcating Sanskaaras.
- Generate awareness about different asanas through yoga among students.
- Develop the virtue of Vasudhaiva-Kutumbakam among students.

### Course Outcome:

On completion of the Course, the students will be able to:

**CO1:** Grasp the fundamentals of Anandamaya Kosha.

**CO2:** Interpret character and personality development for individual, community, and national betterment.

**CO3:** See the correlation between physical development via asana and personal life.

**CO4:** Embrace the principle that the entire world is interconnected as one family.

**Course Content:**

Topics	Hours
<b>Unit I</b>	
<b>Cognitive Development: Anandamaya Kosha</b> - General Introduction, Concept and its requirement. Anandamaya Kosha - in original form of Ananda, Love, Beautifulness, Independence and Spontaneity. Differences among Happiness, Fun, Pleasure and Ananda. Spirituality: Meaning and Nature, Stages of Satta, Chitta and Ananda. Developing the habit of looking inside, Swastha i.e. being in self, Selfless work and Service, <b>Anandamaya Kosha: Realizing Joy, Purpose, and Harmony in Personal and Professional Life</b>	6
<b>Unit II</b>	
<b>Moral Spiritual Development:</b> Contribution of great Indian Personalities in the process of Character-Building and Personality Development (especially in the context of Human, Society and Nation building). Dr. Sarvepalli Radhakrishnan, Dr. Bhimrao Ambedkar, Subhash Chandra Bose, Swami Brahmanand and Dr. Abdul Kalam.	4
<b>Unit III</b>	
<b>Physical Development:</b> Asanas- (to be laid on the side of the abdomen) Makarasana, Dhanurasana, Bhujangasana, Shalbhhasana, Viprit-Naukasana and Khagasana. Pranayama - Bhrastrika, Bhraamri and Ujjayee. Hasta Mudra	8
<b>Unit IV</b>	
<b>Intellectual – Emotional Development :</b> Judiciousness, Swadhayay, Universal Brother-hood, Development of Leadership ,Ekatam Manava Darshan, Social Dignity, Self-Discipline and Sustainable Development. - Shunya Mudra and Apan Mudra.	6

**Suggested Reading:**

1. Light on Yoga, B.K.S.Iyengar – Thorsons, London
2. The Man India Missed the Mos: Subhash Chandra Bose, BhuvanLall, Notion Press, Chennai