DEPARTMENT OF M.C.A

LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

TWO YEARS MCA PROGRAMME

I-IV SEMESTERS

SCHEME AND SYLLABUS

Effective for the students admitted from the academic year
2025 - 2026 and onwards

DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE

(AUTONOMOUS)

College with Potential for Excellence

Linguistic Minority Institution affiliated to University of Madras

E.V.R. PERIYAR HIGH ROAD,

ARUMBAKKAM, CHENNAI – 600106, TAMILNADU.

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SCHEME

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Courses and Syllabus of First Semester

Courses and Syllabus of Second Semester

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INSTITUTION

VISION

- To impart value-based quality academic.
- To empower students with wisdom and to charge them with rich Indian Traditions and culture.
- To invoke the self.
- To broaden the same towards national building, harmony and Universal brotherhood.

MISSION

To ensure sustained progress and development in impartiting quality education, too pioneer new avenues of teaching and research and to emerge as an institution with potential for excellence.

DEPARTMENT OF MCA

VISION

Empower every student to be innovative, creative and productive in the domain of Computer Science by importing quality education, developing skills and inculcating human values.

MISSION

M1	To organize workshops at regular intervals to bridge the gap between the academia and industry.
M2	To enable the students to be industry ready by developing state-of-the-art curriculum in tune with industry requirements.
M3	By providing the necessary skills and to make students to excel in challenging scenario.
M4	To make students to understand the concepts using innovative teaching materials.

PROGRAMME EDUCATIONAL OUTCOMES (PEOs)

PEO1	To progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.
PEO2	To achieve peer-recognition; as an individual or in a team; by adopting ethics and professionalism and communicate effectively to excel well in cross culture and inter-disciplinary teams.
PEO3	To continue a lifelong professional development in computing that contributes in self and societal growth.

PEO TO MISSION STATEMENT MAPPING

Mission	Mission Statement	PEO1	PEO2	PEO3
M1	To organize workshops at regular intervals to bridge the gap between the academia and industry.	3	2	-
M2	To enable the students to be industry ready by developing state-of-the-art curriculum in tune with industry requirements.	3	2	2
M3	By providing the necessary skills and to make students to excel in challenging scenario.	3	2	2
M4	To make students to understand the concepts using innovative teaching materials.	2	-	3

3-Strong 2-Medium 1-Low

PROGRAMME OUTCOMES [POs] FOR POST GRADUATE

PO1	To develop expertise in advanced computing, enabling the design, optimization, and deployment of cutting-edge software solutions for real-world challenges.
PO2	To instill professionalism, integrity, and teamwork, nurturing leaders adept at managing diverse tech teams, communicating effectively, and upholding ethical standards in global business environments.
PO3	To familiarize scholars with transformative trends and their applications, preparing them to innovate solutions for academia and industry.
PO4	To develop the ability to conduct systematic research, critically analyze literature, design methodologies, and derive data-driven insights for scholarly and practical impact.
PO5	To foster entrepreneurial thinking by combining technical innovation, ethical practices, and business strategies, empowering graduates to launch scalable technology ventures.
PO6	To cultivate continuous upskilling (e.g., certifications, self-directed learning) and adaptability, ensuring graduates excel in evolving technological landscapes.

PROGRAMME SPECIFIC OUTCOMES [PSOs] FOR MCA

PSO1	Understand, analyze and develop Computer Programs in the areas related to algorithms, process and solutions for specific application development using appropriate data modeling concepts.
PSO2	Design, develop, test and maintain desktop, web, mobile and cross-platform software applications using latest tools, technologies and skills and computing models and thereby enhance the ability to carry out research, experiment, contemporary issues to solve industrial problems.
PSO3	Develop skill set to communicate one's ideas effectively and to demonstrate team, work as a member/leader to solve complex computing problems and design appropriate techniques to enhance ability for life-long learning.
PSO4	Make graduates to understand cross-cultural, societal, profession, legal and ethical issues prevailing in industry.

ELIGIBILITY FOR ADMISSION

Eligibility for Admission to First Year MCA Degree Programme (as per AICTE norms) is given below:

- A pass in BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree OR a pass in B.Sc./ B.Com./ B.A. with Mathematics at 10+2 level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University) and obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination (as per AICTE norms).
- Candidates should have appeared for the TANCET (MCA) Examination conducted by Anna University Chennai, Chennai 600 025 during the academic year of admission.

DURATION OF THE COURSE

The duration of the course is two academic years consisting of four semester and each semester comprises of 90 working days.

DISSERTATION

Semester IV consists of project and dissertation for 100 marks. The candidate should carry out the project work in any industry or R&D institution under the supervision of a guide from the MCA department. The students will be asked to report to their respective guide for project review at regular intervals. This will be helpful to assess the progress of the work for the award of internal marks. The student will submit two hard copies of their project work (one copy will be retained by the department for permanent record). The viva-voce examination will be held with the help of an external examiner either from academics or industry. The students are encouraged to publish their work in peer-reviewed journal/conference as a part of the project work.

ELIGIBILITY FOR THE AWARD OF THE DEGREE

The students undergoing MCA Programme in Dwaraka Doss Goverdhan Doss Vaishnav College (Autonomous) have to necessarily earn **a minimum of 94 credits** from 2025-2026 onwards to qualify for the award of the MCA degree.

SCHEME OF EXAMINATIONS

As per the University Regulations, the following split up of marks are to be followed:

(i) <u>Split up for Internal and External Marks for Theory and Practical Papers:</u>

Sl.No.	Paper	Internal	External	Total
1	Theory	50	50	100
2	Practical	50	50	100

(ii) **Split up for Internal Assessment Marks for Theory**

CIE- Continuous Internal Evaluation (50 Marks)

CIA (Test 1 and Test 2)	30
Generic Skills	15
Attendance	05
Total	**50**

(iii) End-Semester Examinations-Theory

The ESE for theory courses under Part-I will be conducted for 100 marks over 3 hours, and the marks will be converted to 50 for final evaluation. The ESE for theory courses under Part-II will be conducted for 50 marks over 1.5 hours.

LOCF Abbreviations	Expansion
L	Lecture
T	Tutorial
P	Practical
S	Self-Study
CC	Core Course
CP	Core Practical
MDE	Multi-Disciplinary Elective
AECC-SS	Ability Enhancement Compulsory Course-Soft Skills
DSE	Discipline Specific Elective
SEC-DS	Skill Enhancement Course-Discipline Specific
IS	Internship
IV	Industrial Visit
ECC	Extra Credit Course

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Scheme of Examination
(For the students admitted during the academic year 2025-2026 and onwards)
Credit Distribution

Scheme of I Semester

Programme: M.C.A

SEMESTER I												
Component	**Course Category**	**Course Code**	**Name of the course**	**Credits**	**Hrs Distribution**				**Total contact Hours**	**Marks**		
					L	T	P	S		**CIA**	**ESE**	**Total**
Part I	CC I	2529101	Relational Database Management Systems	4	3	1	-	-	4	50	50	100
Part I	CC II	2529102	Advanced Java Programming Technologies	4	3	1	-	-	4	50	50	100
Part I	CC III	2529103	Algorithms and Data Structures	4	4	-	-	-	4	50	50	100
Part I	CC IV	2529104	Operating System Concepts	4	4	-	-	-	4	50	50	100
Part I	MDE I	2529105	A. Basics of Statistics B. Mathematical Foundations of Computer Applications C. Resource Management Techniques	3	4	-	-	-	4	50	50	100
Part I	CP I	2529106	RDBMS **Lab**	3	1	-	3	-	4	50	50	100
Part I	CP II	2529107	Advanced Java Programming Technologies **Lab**	3	1	-	3	-	4	50	50	100
Part II	AECC-SS I	2550108	Soft Skills I-Business Communication	2	2	-	-	-	2	50	50	100
			Total	**27**	**22**	**2**	**6**	**-**	**30**	**400**	**400**	**800**

Scheme of Examination
(For the students admitted during the academic year 2025-2026 and onwards)
Credit Distribution

Scheme of II Semester

Programme: M.C.A

SEMESTER II												
Component	**Course Category**	**Course Code**	**Name of the course**	**Credits**	**Hrs Distribution**				**Total contact Hours**	**Marks**		
					L	T	P	S		**CIA**	**ESE**	**Total**
Part I	CC V	2529208	Advanced Python Programming	4	3	1	-	-	4	50	50	100
Part I	CC VI	2529209	Full Stack Web Development	4	3	1	-	-	4	50	50	100
Part I	CC VII	2529210	Data Communication and Networks	4	4	-	-	-	4	50	50	100
Part I	DSE I	2529211	A. Information Security Principles B. Cyber Security C. Ethical Hacking	3	3	-	-	-	3	50	50	100
Part I	CP III	2529212	Advanced Python Programming **Lab**	3	1	-	4	-	5	50	50	100
Part I	CP IV	2529213	Full Stack Web Development **Lab**	3	1	-	4	-	5	50	50	100
Part II	AECC-SS II	2550208	Soft Skills II-Aptitude Training I	2	2	-	-	-	2	50	50	100
Part II	SEC-DS I	2529214	Software Engineering	3	3	-	-	-	3	50	50	100
			Total	**26**	**20**	**2**	**8**	**-**	**30**	**400**	**400**	**800**

Internship (IS) will be carried out by the students in the form of mini project using latest technology either preferably in the industry or at home for a duration of 4-6 weeks during the vocation following the second semester examinations. The mentors will act as the respective guides to the students and they will constantly monitor the progress of the project through online/offline mode. The marks for the internship will be reflected in the third semester marksheet.

Scheme of Examination
(For the students admitted during the academic year 2025-2026 and onwards)
Credit Distribution

Scheme of III Semester

Programme: M.C.A

SEMESTER III												
Component	**Course Category**	**Course Code**	**Name of the course**	**Credits**	**Hrs Distribution**				**Total contact Hours**	**Marks**		
					L	T	P	S		**CIA**	**ESE**	**Total**
Part I	CC VIII	2529315	Big Data Frameworks	4	3	1	-	-	4	50	50	100
Part I	CC IX	2529316	Mobile Application Development	4	3	1	-	-	4	50	50	100
Part I	CC X	2529317	Machine Learning	4	4	-	-	-	4	50	50	100
Part I	DSE I	2529318	A. Essentials of IoT Systems B. Blockchain and Cryptocurrency C. Principles of Cloud Computing	3	3	-	-	-	3	50	50	100
Part I	CP V	2529319	Big Data Frameworks **Lab**	3	1	-	4	-	5	50	50	100
Part I	CP VI	2529320	Mobile Application Development **Lab**	3	1	-	4	-	5	50	50	100
Part I	IS	2529321	Internship	2	-	-	-	-	-	50	50	100
Part II	AECC-SS III	2550310	Soft Skills III-Aptitude Training II	2	2	-	-	-	2	50	50	100
Part II	SEC-DS II	2529322	DevOps Methodologies	3	3	-	-	-	3	50	50	100
			Total	**28**	**20**	**2**	**8**	**-**	**30**	**450**	**450**	**900**

Scheme of Examination
(For the students admitted during the academic year 2025-2026 and onwards)
Credit Distribution

Scheme of IV Semester

Programme: M.C.A

SEMESTER IV													
Component	**Course Category**	**Course Code**	**Name of the course**	**Credits**	**Hrs Distribution**				**Total contact Hours**	**Marks**		
					L	T	P	S		**CIA**	**ESE**	**Total**
Part I	CC XI	2529423	Project Work and Viva Voce	10	-	-	-	-	-	50	50	100
Part II	AECC-SS IV	2550411	Soft Skills IV-Personality Excellence	2	2	-	-	-	2	50	50	100
Part II	IV	2529424	Industrial Visit	1	-	-	-	-	-	-		-
			Total	**13**	**2**	**-**	**-**	**-**	**2**	**100**	**100**	**200**

Extra Credit Courses (ECC)

The department will offer Spoken Tutorial and Swayam course to earn **six extra credits**. This is in addition to the **minimum mandatory credits of 94** as per the norms prescribed by AICTE. It should be noted that the below courses are purely optional for the MCA students to take in addition to the above given mandatory 94 credits.

Course Category	Semester	Name of the Course	Credit(s)	Evaluation Pattern
ECC	I	Spoken Tutorial I-Linux	1	**Spoken Tutorial Courses** are offered by IIT Mumbai through Spoken Tutorial Project, funded by the MHRD, Govt. of India. The spoken tutorial courses decided by the department from time to time and approved by the Board of Studies/Academic Council will be offered to the students to earn one extra credit. The course will be offered through online mode and after the completion of the course, an Online Examination will be conducted by IIT Mumbai on a suitable date convenient to them. This online examination will be under the supervision of a department faculty in the MCA Laboratory. When the students complete the examination, immediately their scores (passing minimum 40%) will be revealed and the soft copy of the certificate will be generated in this regard. The qualified students, who have passed the examination in the first attempt will submit the hard copy of the
ECC	II	Spoken Tutorial II-Python	1	
ECC	III	Spoken Tutorial III-GIT	1	
ECC	IV	Spoken Tutorial IV-LaTex	1	

				certificate to the department to earn one extra credit. Then, the department will forward the consolidated report to the COE's office to award one extra credit to the successful students.
ECC	IV	Swayam Course	2	The interested students will approach their respective mentors to get their valuable suggestions for enrollment to an online course in Computer Science of not less than 8 weeks duration under the Swayam Platform to get two extra credits. The qualified students are requested to submit the hard copy of the certificate latest by the end of the second year of the MCA Programme (in the month of May) to earn the two extra credits in the final (fourth) semester mark sheet. Finally, the department will forward the consolidated report to the COE's office to award two extra credits to the successful students.

Abstract of

Scheme of Examination

(For the students admitted during the academic year 2025-2026 and onwards)

✓ The students undergoing MCA Programme in DDGD Vaishnav College (Autonomous) have to necessarily earn **a minimum of 94 credits** from 2025-2026 onwards to qualify for the award of the MCA degree.

✓ The final decision on the minimum number of credits will be decided by the department in the Board of Studies meeting and approval/ratification for the same will be obtained in the subsequent Academic Council meeting for implementation from time to time.

✓ **Part-II courses** are not included in Total Marks and CGPA Calculation.

SEMESTER	MANDATORY CREDITS
I	27
II	26
III	28
IV	13
Total Mandatory Credits	**94**

Sl.No.	Category	Course Component	No. of Courses	Credits	Total Credits
Mandatory Credit Courses					
1	**PART I**	Core Theory	10	4	40
2		Core Project	1	10	10
3		Core Practical	6	3	18
4		Internship	1	2	02
5		Multi Disciplinary Elective	1	3	03
6		Discipline Specific Elective	2	3	06
7	**PART II**	Soft Skills	4	2	08
8		Skill Enhancement Course-Discipline Specific	2	3	06
9		Industrial Visit	1	1	01
Total (Mandatory Credits)					**94**
Extra Credit Courses					
10	ECC	Spoken Tutorial	4	1	04
11	ECC	Swayam	1	2	02
Total (Extra Credits)					**06**

DEPARTMENT OF MCA

FIRST SEMESTER

CORE COURSE I: RELATIONAL DATABASE MANAGEMENT SYSTEMS

Course Code	**: 2529101**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram*
- *To make a study of SQL and relational database design.*
- *To know about data storage techniques and query processing.*
- *To impart introductory knowledge on NoSQL.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Explain difference between file system and database system, the basic concepts of data models and its classification like ER model, relational model, network model, object oriented model and case study as ER model.
CO2	Discuss the relational database terminologies; analyze types of keys in relational database system. Understand the Relational algebra and improve the performance of database by normalization and hence the types of normal forms.
CO3	Implementation of Relational Database in Oracle SQL, analyzing of DDL, DML and DRL statements, Joins, Group functions and Integrity Constraints with syntax and examples.
CO4	Demonstrate the types of PL/SQL statements with examples and hence discuss the purpose of Cursors, Triggers, Procedures and Functions in PL/SQL with its implementation.
CO5	Analyze the types of subprograms in PL/SQL like functions and procedures. Describe how to write triggers in PL/SQL block. Explain the Transaction States and properties of Transactions.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	2	1	-	1	3	2	1	1
CO2	3	1	2	2	-	1	3	2	1	-
CO3	3	2	2	2	1	2	3	3	2	1
CO4	3	2	2	2	1	2	3	3	2	1
CO5	3	2	2	2	1	2	3	3	2	1

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	Introduction to Databases- Characteristics of the Database -Advantages of using DBMS - Categories of Data Models-Schemas and Instances -Three-Schema Architecture-Data Independence–**Conceptual Modeling using ER Model:** Entities and Attributes, Entity types and Entity sets, Relationship types, Degree of a Relationship Type, Weak Entity types, Notations for ER diagrams, Naming Conventions, An Example ER diagram.	**12**	**CO1**
2	**Relational Model Concepts**: Domains, Attributes, Tuples, Relations, Types of Keys- **Relational Algebra**: Unary Operations, Operations from Set Theory, Cartesian product, Division and Rename. **Normalization**: Purpose of Normalization – Functional Dependencies	**12**	**CO2**

	–First Normal Form, Second Normal Form, Third Normal Form-Boyce-Codd Normal Form (BCNF).		
3	**Basic SQL:** Attribute Data types and Domains in SQL -DDL Commands- DML Commands- Select statement using where, in, between, order by, like, distinct, relational operators and logical operators- Numeric functions-Character functions -Date functions- - SQL Group functions - SQL Set Operators – Commit-Rollback-Integrity Constraints in SQL.	**12**	**CO3**
4	Nested Query-Inner Joins-Outer Joins-**PL/SQL**: Structure of PL/SQL Block-Decision making statements in PL/SQL-Loop Statements in PL/SQL-**Cursors**: Implicit Cursor- Explicit Cursor- **Exception Handling**: Built-in Exceptions -User-Defined Exceptions.	**12**	**CO4**
5	**Subprograms in PL/SQL:** Procedures and Functions- **Triggers in PL/SQL:** Syntax, Benefits and types of triggers- **Transaction and System Concepts:** Transaction States, The System Log, Commit point of a Transaction, Desirable properties of Transactions.	**12**	**CO5**

Text Books:

1. Ramez Elmasri and Shamkant B. Navathe**, "Fundamentals of Database Systems"**, 7th Edition, Pearson Education, 2017. (Modules I,II,V)
2. Sharad Maheswari and Ruchin Jain, "**Introduction to SQL and PL/SQL**", Firewall Media, 2016. (Modules III,IV)

Reference Books:

1. Dr. Sanjeev Sharma, "**Advanced Database Management Systems***"*, 1st Edition, Wiley India, 2024.
2. Avi Silberschatz, Henry F. Korth and S. Sudarshan**. "Database System Concepts"**, 6th Edition, McGraw Hill, 2020.
3. Raghurama Krishnan and Johannes Gehrke, "**Data Base Management Systems**", TMH 3rd Edition,2003

E-References:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://www.db-book.com/db6/slide-dir/index.html
3. https://beginnersbook.com/2015/04/dbms-tutorial/
4. https://www.technolamp.co.in/2011/09/database-management-systems-dbms-imp.html

DEPARTMENT OF MCA

FIRST SEMESTER

CORE COURSE II: ADVANCED JAVA PROGRAMMING TECHNOLOGIES

Course Code	**: 2529102**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- To develop robust, scalable, and high-performance applications using advanced Java technologies and frameworks
- Students will be able to understand integrated development environment to create, debug and run multi-tier and enterprise level applications
- To develop distributed applications
- Analyzing different problems in web applications and providing solutions
- Applying the knowledge to develop web applications for industries and individual

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Explain the enterprise architectures.
CO2	Describe how servlets fit into java-based web application architecture
CO3	Explain the concepts and terminologies of JSP
CO4	Apply JDBC skills to develop database-driven applications, improving software development capabilities
CO5	Describe the process of developing RMI applications

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	1	1	2	3	3	2	1
CO2	3	2	2	1	-	1	3	3	2	1
CO3	3	2	2	-	-	1	3	3	2	1
CO4	3	2	2	2	1	2	3	3	2	1
CO5	3	2	2	1	-	2	3	3	2	1

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction**: Need for Enterprise Programming - Client-Side programming - Server-Side Programming - Advantages of J2EE -Enterprise Architecture Types- Two tier Architecture-Three Tier Architecture-Multi-tier Architecture-J2EE Architecture - J2EE Containers –Types of J2EE Technology-Component Technology-Service Technology-Communication Technology.	**12**	**CO1**
2	**Servlets**: Servlet Lifecycle-Types of Servlets-GenericServlet-HttpServlet – Reading Servlet Parameters - Servlet Collaboration - RequestDispatcher - forward method - include method - sendRedirect - Session Tracking Techniques -URL Rewriting - Hidden Form Fields – Cookies-HttpSession.	**12**	**CO2**
3	**JSP**: JSP Overview – Advantages of JSP over Servlet - Life Cycle of a JSP Page - Scripting Elements in JSP - Scriptlet Tag - Expression Tag - Declaration Tag - JSP Directives - page directive - include directive - JSP implicit objects – Exception handling	**12**	**CO3**

	in JSP – JSP Action tags- forward - include.		
4	**JDBC**: Introduction to JDBC – Applications of JDBC – Architecture of JDBC – Components of JDBC - Types of JDBC Drivers - JDBC Connection - JDBC Statement - Resultset- Navigational methods - Get methods - Update method -Transaction management-Create a simple JDBC application to perform CRUD operations.	**12**	**CO4**
5	**RMI**: RMI Overview – RMI Architecture - RMI Components - Developing applications with RMI - Declaring & Implementing remote interfaces - stubs & skeletons - Registering remote objects - writing RMI clients – Pushing data from RMI Server-Build client-server application using RMI.	**12**	**CO5**

Text Books:

1. J.McGovern, R.Adatia,Y. Fain," **J2EE 1.4 Bible**", Wiley-Dreamtech India Pvt.Ltd, New Delhi, 2021.
2. Thompson carter,"**ADVANCED JAVA PROGRAMMING**",Lincoln Publishers,2024.

Reference Books:

1. Prof. Pushpender Sarao,"**Advanced Java Programming: Applet, JDBC, Bean, Network Programming, Servlet**", LAP Lambert Academic Publishing, 2023.
2. Kogent Solution Inc "**Java 6 Programming Black Book, New Ed**", Dreamtech Press,. New Edition, 2012.
3. Kathy Walrath, "**The J2EE tutorial**" , 1st ed., Addison Wesley Publishers, 2005.
4. Jim Keogh, "**J2EE the Complete Reference**", First Edition, Tata McGraw Hill, 2002
5. Maydene Fisher, Jon Ellis, Jonathan Bruc,"**JDBC™ API Tutorial and Reference**", Third Edition, e, Addison Wesley
6. Jason Hunter, William Crawford, "**Java Servlet Programming**", Second Edition, O'Reilly, 2001

E-References:

1. https://www.edureka.co/blog/advanced-java-tutorial
2. https://www.javatpoint.com/jsp-tutorial
3. https://www.javatpoint.com/servlet-tutorial
4. https://docs.oracle.com/javase/8/docs/technotes/guides/jdbc

DEPARTMENT OF MCA

FIRST SEMESTER

CORE COURSE III: ALGORITHMS AND DATA STRUCTURES

Course Code	**: 2529103**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To impart the knowledge about the concepts of data structures and algorithms.*
- *To enable the students to analyze the efficiency of algorithms.*
- *Train the students to design and analyze linear and non-linear data structures.*
- *Enable the students to implement suitable data structures and algorithms in real time applications*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the types of data structures and illustrate the working of arrays, stacks, queues, linked lists as examples for the same.
CO2	Describe the types of trees, binary tree traversals and some types of trees like AVL trees and Red-Black trees.
CO3	Illustrate different types of graphs and its applications like shortest path algorithm and minimum cost spanning tree.
CO4	Understand the nature of algorithmic procedures like divide and conquer and greedy method.
CO5	Determine the working of dynamic programming, backtracking and branch and bound algorithmic techniques with examples.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	-	-	1	3	3	2	-
CO2	3	2	2	2	-	1	3	3	2	-
CO3	3	2	2	2	-	1	3	3	2	-
CO4	3	2	2	2	-	1	3	3	2	-
CO5	3	2	2	2	-	1	3	3	2	-

3-Strong 2-Medium 0-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction:** Definition and types of Data structures- Asymptotic notations – Complexity analysis – **Arrays:** Features, types and limitations of arrays - **Linked lists:** Advantages and limitations of linked lists-Singly linked list- Doubly linked lists-**Application of linked list**: Polynomial Addition- **Stacks**: Operations on stack, array representation of stack-**Applications of Stack**: Conversion of Infix to Postfix Notation and Evaluation of Postfix expression - **Queues**: Operations on queues - Circular queues-Applications of queue.	**12**	**CO1**
2	**Trees:** Tree Terminologies-Applications of trees-Binary Tree concepts-Representation of a binary tree-**Binary Tree Traversals**: Inorder, preorder and postorder traversals— Binary Search Trees – Threaded Binary Trees-**Balanced trees**: AVL Trees and Red- Black Trees.	**12**	**CO2**
3	**Graphs:** Graph terminologies -**Representation of Graphs**: Adjacency matrix and Adjacency list– **Graph Traversals**: Breadth First Traversal and Depth First Traversal-**Applications of Graph**: Dijkstra's Single-Source Shortest Path algorithm and Kruskal's Minimum Cost Spanning Tree algorithm.	**12**	**CO3**

4	**Divide and Conquer**: General Method- Quick sort, Merge sort and Binary Search-**Greedy Method:** General Method – Optimal Storage on Tapes, Job Sequencing using Deadlines and Knapsack Problem.	**12**	**CO4**
5	**Dynamic Programming:** General Method- Multistage Graphs and Floyd's All Pair Shortest Path Algorithm **-Back Tracking**: General Method – Graph Coloring and Hamiltonian Cycle Problem-**Branch and Bound**: General Method-LIFO and FIFO approach- 0/1 Knapsack Problem.	**12**	**CO5**

Text Books:

1. G.A. Vijayalakshmi Pai, "**Data Structures and Algorithms: Concepts, Techniques and Applications***"*, 1st Edition, Wiley-ISTE, 2023.
2. Anuradha A. Puntambedkar, "**Design and Analysis of Algorithms**", First Edition, 2022, Technical Publications.

Reference Books:

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, 5th Edition, 2017.
2. S.K. Basu ,"**Design Methods and Analysis of Algorithms**", Fourth Edition ,2013.
3. Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran, *"***Fundamentals of Computer Algorithms***"*, 2nd Edition, Universities Press, 2008.
4. R. K. Ghosh, "**Algorithms**", Prentice-Hall India, 2nd edition, 2006.

E-References:

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://www.programiz.com/dsa
3. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
4. https://www.javatpoint.com/daa-tutorial

DEPARTMENT OF MCA

FIRST SEMESTER

CORE COURSE IV: OPERATING SYSTEM CONCEPTS

Course Code	**: 2529104**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To be aware of the evolution and fundamental principles of operating system, processes and their communication*
- *To understand the various operating system components like process management, memory management*
- *To know about file management and the distributed file system concepts in operating systems*
- *To be aware of components of operating system with relevant case study.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Defining the need of operating system components and evolution, its architecture and different types of system calls. Introduce the concept of process, operations and scheduling and thereby explain the concept of process scheduling, CPU scheduling criteria and algorithms.
CO2	Acquire the knowledge of process synchronization and illustrate the critical section problems and ways to handle the dead lock problems with the help of algorithms.
CO3	Explain and discuss the background of memory with segmentation and paging techniques and the virtual memory management with various page replacement algorithms
CO4	Sketch out the various storage structures with different disk scheduling algorithms. Describe file management with file organization, file access methods, B-trees, and File System security.
CO5	Explain how a Linux server can be integrated within a multi-platform environment.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2	-	1	3	3	2	1
CO2	3	2	2	2	-	1	3	3	2	1
CO3	3	2	2	2	-	1	3	3	2	1
CO4	3	2	2	2	-	1	3	3	2	1
CO5	3	2	2	2	-	1	3	3	2	1

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	Introduction: Types of operating systems-operating systems services-System calls-Systems programs-Process Management: Process concept- Process Scheduling-Operation on Processes-Co-Operating Processes- Interprocess Communications-CPU Scheduling: Scheduling Criteria-Scheduling algorithms.	**12**	**CO1**
2	Process Synchronization –Critical Section Problem – Semaphores-Classical problems of synchronization-Deadlock Characterization-Deadlock Prevention-Deadlock Avoidance-Deadlock Detection-Deadlock Recovery.	**12**	**CO2**
3	Memory Management-Swapping-Contiguous Memory Allocation-Paging-Segmentation-Virtual Memory-Demand paging-Page Replacement-Thrashing.	**12**	**CO3**

4	Disk Structures-Disk Scheduling Algorithms-File Systems Organization-File Concepts-File Operations-Access Methods-Directory Structures-File System Implementation-Directory Implementation-Allocation Methods-Free Space management.	**12**	**CO4**
5	History of Linux- Properties of Linux-Linux Commands-Overview of the Linux file system-Manipulation of files –File Security.	**12**	**CO5**

Text Book:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, **"Operating System Concepts"**, 10th Edition, John Wiley & Sons, 2018.

Reference Books:

1. Rohit Khurana, **"Operating System"**, 2nd Edition, Vikas Publishing, 2025.
2. H M Deital, P J Deital and D R Choffnes, "**Operating Systems**", 3rd edition, Pearson Education, 2011.
3. William Stallings, "**Operating Systems: Internals and Design Principles**", Seventh Edition, Prentice Hall, 2011.
4. Andrew S.Tanenbaum, "**Modern operating Systems**", Third Edition, PHI Learning Pvt. Ltd., 2008.
5. D M Dhamdhere, "**Operating Systems: A Concept-based Approach**", Second Edition, Tata McGraw-Hill Education, 2007.

E-References:

1. https://www.tutorialspoint.com/operating_system/index.htm
2. https://www.javatpoint.com/os-tutorial
3. https://nptel.ac.in/courses/106/105/106105214/

DEPARTMENT OF MCA

FIRST SEMESTER

MULTI DISCIPLINARY ELECTIVE I: BASICS OF STATISTICS

Course Code	**: 2529105 (A)**	**Credits**	**: 03**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To provide an understanding of the statistical methods and probabilistic concepts by which real- life problems are analyzed (Focus on problems- No derivations)*
- *To develop the students ability to deal with numerical and quantitative issues*
- *To enable the use of statistical, graphical and algebraic techniques wherever relevant.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Recall the concepts of sample spaces, events, axiomatic approach, conditional probability, Baye's theorem. Summarize the random variables, expectation and variance. Demonstrate the Chebyshev's inequality.
CO2	Distinguish Discrete and continuous distributions. Solve the real time problems involving various distributions like Binomial, Poisson and normal distributions. Explain the concept of Bivariate analysis and point out the importance of correlation analysis, Regression analysis and various curves using method of least squares.
CO3	Summarize the concept of sampling and various methods of sampling. Point out the various errors such as standard error, type I error, type II error. Explain the Null Hypothesis and alternative hypothesis. Point the importance of estimation.
CO4	Differentiate large and small samples. Compare the various parametric tests like Z-test, t-test, F test by giving practical examples. Explain the non-parametric chi square test with illustrated examples
CO5	Restate the analysis of variance and classify the one way and two classifications. Categorize the computing randomized design and randomized block design. Define time series and list the components of time series. Illustrate the measurement of trend and seasonal variations.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2	-	1	3	3	2	-
CO2	3	2	2	2	-	1	3	3	2	-
CO3	3	2	2	2	-	1	3	3	2	-
CO4	3	2	2	2	-	1	3	3	2	-
CO5	3	2	2	2	-	1	3	3	2	-

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	Sample spaces - Events - Axiomatic approach to Probability - Conditional Probability - Independent Events -Baye's Formula - Random Variables - Continuous and Discrete Random Variables - Distribution Function of a Random Variables - Expectation, Variance - Coefficient of Variation -Chebyshev's Inequality.	**12**	**CO1**
2	Bivariate Distribution – Conditional and Marginal Distributions – Discrete Distributions: Discrete, Uniform, Binomial, Poisson and Geometric Distributions – Continuous	**12**	**CO2**

	Distributions: Uniform, Normal, Exponential and Gamma Distributions (only simple problems).		
3	Correlation: Bivariate Data - Correlation between Two Variables - Covariance between Two Variables - Karl Pearson's Coefficient of Correlation - Rank Correlation. Regression Analysis: Simple Linear Regression - Regression Equations.	**12**	**CO3**
4	Concepts of Sampling Distributions and Standard Error -Point Estimation (Concepts Only) - Interval Estimation of Mean and Proportion. Tests of Hypotheses - Critical Region - Two Types of Errors - Level of Significance - Power of the Test - Large Sample Tests for Mean and Proportion - Exact Tests Based on Normal, t, f and Chi-Square Distributions.	**12**	**CO4**
5	Basic Principles of Experimentation – Analysis of Variance – One Way and Two Way Classifications – Computing Randomized Design – Randomized Block Design.	**12**	**CO5**

Text Book:

1. Gupta S.C and Kapoor V.K, "**Fundamentals of Mathematical Statistics**", 12th Edition, Sultan Chand & Sons, India, 2020.

Reference Books:

1. T.K.V. Iyengar, M.V.S.S.N. Prasad, S. Ranganatham, B. Krishna Gandhi**, "Probability and Statistics",** 7th Edition, S. Chand Publishing, 2025.
2. P.R.Vital, "**Mathematical Statistics**", Margham Publication, 2015.
3. Erwin Miller and John E.Freund, "**Probability and Statistics for Engineers**", 7th Edition, Pearson Education, India, 2017.
4. James T. McClave and Terry Sincich, "**Statistics**", 12th Edition, Pearson Education, India, 2013.
5. Trivedi, K.S, "**Probability and Statistics with Reliability, Queuing and Computer Science Applications**", Prentice Hall India,1994.

E-References:

1. https://nptel.ac.in/courses/111/105/111105041/
2. https://nptel.ac.in/courses/111/105/111105043/
3. https://nptel.ac.in/courses/110/106/110106064/

DEPARTMENT OF MCA

FIRST SEMESTER

MULTI DISCIPLINARY ELECTIVE I: MATHEMATICAL FOUNDATIONS OF COMPUTER APPLICATIONS

Course Code	**: 2529105 (B)**	**Credits**	**: 03**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To introduce the concepts of mathematical logic.*
- *To introduce the concepts of sets, relations, and functions.*
- *To perform the operations associated with sets, functions, and relations.*
- *To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.*
- *To use Graph Theory for solving problems.*
- *To use Tree for solving problems.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Understand sets, relations, functions and discrete structures.
CO2	Ability to apply the acquired knowledge of basic skills in partial ordering relations, principles of computing, design of computer- based systems in solving real world Problems using Automata Theory.
CO3	Ability to apply mathematical logic to solve problems. Able to use logical notations to define and reason about fundamental mathematical concepts such as sets relations and functions.
CO4	Able to model and solve real world problems using graphs.
CO5	Able to model and solve real world problems using trees.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	-	-	1	3	3	2	-
CO2	3	2	2	2	-	1	3	3	2	1
CO3	3	2	2	2	-	1	3	3	2	-
CO4	3	2	2	2	-	1	3	3	2	-
CO5	3	2	2	2	-	1	3	3	2	-

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Sets:** Basic Concepts - **Relations:** Binary relations, Equivalence relations and partition - **Functions:** Different types of functions, Composition and Inverse, Recursive and hashing functions. Mathematical Induction.	**12**	**CO1**
2	**Partial Ordering Relations: Partially ordered set:** Representation of Poset - Hasse Diagram, LUB, GLB, well ordered set, meet and join of elements - **Lattices as partially ordered sets:** Definition and basic properties, Lattices as algebraic systems, sub lattices - Basic Concepts of **Automata Theory:** Alphabets, Strings, Languages, DFA, NFA and their representations.	**12**	**CO2**
3	**Mathematical logic:** Logical operators – Conjunction, Disjunction, Negation, Conditional and biconditional. Truth tables. Equivalence formula, Tautology, methods of proof-direct, indirect, contradiction, equivalence and induction. Inference Theory, Validity by truth	**12**	**CO3**

	table, Rules of Inference - **Predicate Calculus:** Predicates , statement functions, variables and quantifiers, predicate formulas, free and bound variables, the universe of discourse.		
4	**Graph Theory:** Basic terminology: Different types of graphs – Directed and undirected, Simple, Pseudo, Complete, Regular, Bipartite. Incidence and degree, Pendant and Isolated vertex and Null graph. Isomorphism, Sub graphs, Walk, Path and Circuit, Connected and disconnected graphs and components, operations on graphs. Euler Graphs, Hamiltonian circuits and paths. Traveling salesman problem. Matrix representation of graphs – Incidence and Adjacency matrices.	**12**	**CO4**
5	**Trees:** Basic properties, Rooted and binary trees, Binary search trees, Tree traversals – Pre order, In order and Post order, Spanning Trees, Prims and Kruskals algorithm. **Planar graphs:** Kuratowski's two graphs and Euler's formula. Detection of planarity.	**12**	**CO5**

Text Books:

1. Jean-Paul Tremblay and R. Manohar, **"Discrete Mathematical Structures with Applications to Computer Science",** 1st Edition, McGraw-Hill Education, 2017.

Reference Books:

1. Narsingh Deo, **"Graph Theory with Applications to Engineering and Computer Science"**, Prentice-Hall of India, 2025.
2. K.L.P. Mishra and N. Chandrasekaran, **"Theory of Computer Science: Automata, Languages and Computation"**, 3rd Edition, Prentice-Hall of India, 2016.
3. Kenneth H. Rosen, "**Discrete Mathematics and Its Applications**", Tata McGraw-Hill Publications, 7th Edition, 2012.
4. Y.N. Sings, "**Mathematical Foundation of Computer Science**", New Age International Publishers, 2nd Edition, 2012.
5. Hopcroft and J.D. Ullman, "**Introduction to Automata Theory, Languages and Computation**", Narosa Publications, 3rd Edition, 2006.
6. Bernard Kolman, Robert C. Busby & Sharon Ross, **"Discrete Mathematical Structures"**, Prentice Hall of India, 2001.
7. D.S. Malik, "Discrete Mathematical Structures, Theory and Applications", Thomson Learning, I Edition, 2000.
8. Haggard, "Discrete Mathematics for Computer Science", Thomson Learning, I Edition, 2000.

E-References:

1. https://biet.ac.in/pdfs/CSE-MFCS.pdf
2. https://rgmcet.edu.in/assets/img/departments/CSE/materials/R19/2-1/MFCS.pdf

DEPARTMENT OF MCA

FIRST SEMESTER

MULTI DISCIPLINARY ELECTIVE I: RESOURCE MANAGEMENT TECHNIQUES

Course Code	**: 2529105 (C)**	**Credits**	**: 03**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To help students to understand operations research methodologies*
- *To help students to solve various problems practically*
- *To make students proficient in case analysis and interpretation*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Able to formulate the real-life problem into an appropriate mathematical model.
CO2	Able to choose and apply the appropriate techniques to solve the formulated model. Able to understand the advanced analytical methods like Linear Programming Methods to help make better decisions.
CO3	Able to understand the advanced analytical methods like Transportation and Assignment to help make better decisions.
CO4	Able to understand the advanced analytical methods like Sequencing and Theory of Games methods to help make better decisions.
CO5	The ability to grasp the latest development, methodologies to posses competent knowledge of design process, practical proficiencies, skills and knowledge of programme and developing ideas towards research.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2	1	1	3	3	2	-
CO2	3	2	2	2	1	1	3	3	2	-
CO3	3	2	2	2	1	1	3	3	2	-
CO4	3	2	2	2	1	1	3	3	2	-
CO5	3	2	2	2	1	1	3	3	2	1

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction:** Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR, Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. Solutions to LPP by graphical method (Two Variables).	**12**	**CO1**
2	**LPP:** Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two-Phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.	**12**	**CO2**
3	**Transportation Problem:** Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of	**12**	**CO3**

	transportation problem. **Assignment Problem:** Formulation, Solutions to assignment problems by Hungarian method, Special cases in assignment problems, unbalanced, Maximization assignment problems. Travelling Salesman Problem (TSP). Difference between assignment and Ttransportation Problem.		
4	**Sequencing:** Basic assumptions, Johnson's algorithm, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing of 2 jobs on 'm' machines using graphical method. **Game Theory:** Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method	**12**	**CO4**
5	**Network analysis:** Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project.	**12**	**CO5**

Text Book:

1. P.K. Gupta and D.S. Hira, **"Operations Research"**, 7th Edition, S. Chand & Company Ltd., New Delhi, 2022.

Reference Books:

1. Paneerselvan, **"Operations Research",** PHI, 2020.
2. J.K. Sharma**, "Operations Research, Theory and Applications",** 6th Edition, Trinity Press, Laxmi Publications Pvt. Ltd., 2016.
3. Hamdy A. Taha**, "Operations Research - An Introduction",** 10th Edition, Pearson Education, 2017.
4. Hillier and Lieberman**, "Introduction to Operations Research",** 10th Edition, TMH, 2015.
5. A.M. Natarajan, P. Balasubramani**, "Operations Research",** Pearson Education, 2005**.**

E-References:

1. www.informs.org
2. http://nptel.iitm.ac.in/video.php?subjectId=112106134
3. http://www.wikihow.com/Use-the-Hungarian-Algorithm
4. http://www.youtube.com/watch?feature=player_embedded&v=BUGIhEecipE
5. www.scienceofbetter.org
6. http://canmedia.mcgrawhill.ca/college/olcsupport/stevenson/om3ce/IOM_applets/hungarianMethod/Hungarian.html

DEPARTMENT OF MCA

FIRST SEMESTER

CORE PRACTICAL I: RDBMS LAB

Course Code	**: 2529106**	**Credits**	**: 03**
L:T:P:S	**: 1:0:3:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 50**

Learning Objectives:

- *To explain basic database concepts, applications, data models, schemas and instances.*
- *To demonstrate the use of constraints and relational algebra operations.*
- *Describe the basics of SQL and construct queries using SQL.*
- *To emphasize the importance of normalization in databases.*
- *To facilitate students in Database design*

Lab Exercises:

1. DDL Statements
2. DML Statements
3. SELECT statement
4. Numeric functions
5. Character functions
6. Date functions
7. Group Functions
8. Set Operations
9. Nested query
10. Joins
11. Commit and Rollback
12. PL/SQL-Decision Making statements
13. PL/SQL-Looping statements
14. PL/SQL-Cursors
15. PL/SQL-Exception Handling
16. PL/SQL-Functions
17. PL/SQL-Procedures
18. PL/SQL-Triggers

DEPARTMENT OF MCA

FIRST SEMESTER

CORE PRACTICAL II: ADVANCED JAVA PROGRAMMING TECHNOLOGIES LAB

Course Code	**: 2529107**	**Credits**	**: 03**
L:T:P:S	**: 1:0:3:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 50**

Learning Objectives:

- Build a basic Java web application.
- *Implement and manage web sessions with Servlets.*
- *Develop a complete web application using JSP.*
- *Connect and interact with databases using JDBC (Java Database Connectivity).*
- *Invoke remote methods in a Java application using RMI (Remote Method Invocation.*

Lab Exercises:

1. Html to Servlet Communication
2. Servlet Collaboration-Request Dispatcher- forward - include
3. Servlet Collaboration-SendRedirect
4. Session Management and Implementation of URL Rewriting using Servlet
5. Session Management and Implementation of Hidden Form Field using Servlet
6. Session Management and Implementation of HttpSession using Servlet
7. Session Management and Implementation of Cookies using Servlet
8. Create a JSP for login module.
9. Write down the program in which input the two numbers in an html file and then display the addition in JSP file.
10. Write down the Program for testing the include action tag in jsp.
11. Write down the Program for testing the forward action tag.
12. JSP exception handling
13. Design a JDBC application which will demonstrate CRUD operation.
14. Design a JDBC application which will demonstrate Transaction management functionality.
15. Creating Web services with RMI.
16. Create a simple calculator application that demonstrates the use of RMI.

DEPARTMENT OF MCA

FIRST SEMESTER

SOFT SKILLS I: BUSINESS COMMUNICATION

Course Code	**: 2550108**	**Credits**	**: 02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 1.5**	**ESE Marks**	**: 50**

Module-1: Concept of Communications
Introduction: Definition and Process of Communication - Forms of Verbal and Non-verbal Communication. **Barriers of Communication**: Communication Barriers and Overcoming Communication Barriers - Guidelines for Effective Communication. Business Writing: Direct and Indirect approaches to Business Writing - Five Main Stages of Writing Business Messages.
Exercise: Role Play, Square Talk Activity.

Module-II: Oral Communication
Public Speaking: Types of Public Speaking - importance of Public Speaking. **Power Point Presentation**: Planning the Presentation - Delivering the Presentation - Developing & Displaying Visual Aids - Handling Questions from the Audience. Listening: Definition - Types of Listening Skills - Features of a Good Listener - Causes and effects of Poor Listening.
Exercise: Elocution and Extempore

Module-III: Behavioral Techniques
Body Language: Facial Expressions - Body Posture - Gestures - Eye Movement - Touch and the use of Personal Space. **Business Attire and Grooming**: Different types of Attire - Guidelines for Business Attire.
Exercise: Power of Body Language, Charades.

Reference Books:

1. Meenakshi Raman and Prakash Singh, "**Business Communication**", Oxford, 2022.
2. Lesikar, "**Basic Business Communication**", TMH, 2020.
3. David Irwin, "**Effective Business Communications**", Viva-Thorogood, 2015.
4. Rajendra Pal, J.S. Korlaha, "**Essentials of Business Communication**", Sultan Chand & Sons, New Delhi, 2013.

********End of First Semester********

DEPARTMENT OF MCA

SECOND SEMESTER

CORE COURSE V: ADVANCED PYTHON PROGRAMMING

Course Code	**: 2529208**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To introduce Python programming language through its core language basics and program design techniques suitable for modern applications.*
- *To understand the wide range of programming facilities available in Python covering graphics, GUI, data visualization and Databases.*
- *To utilize high-performance programming constructs available in Python to develop solutions in real life scenarios.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Examine the basic and important concepts in Python to understand the language and illustrate the working of functions in Python.
CO2	Create and examine the working of core data structures like strings, lists, dictionaries, tuples and sets. Analyze the exception handling mechanism in Python.
CO3	Evaluate the concepts of file handling, working of modules like numpy, scipy. Study about database connectivity in Python using MySQL.
CO4	Know about the object-oriented concepts with Python using class, object, inheritance, polymorphism concepts. Illustrate the data visualization capacity of Python using matplotlib and seaborn.
CO5	Discover the dataset manipulation using Pandas Dataframe.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	1	-	2	3	3	2	1
CO2	3	2	2	2	1	2	3	3	2	1
CO3	3	2	2	2	1	2	3	3	2	1
CO4	3	2	2	2	1	2	3	3	2	1
CO5	3	2	2	2	1	2	3	3	2	1

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Python Basics:** History, Features, Data Types, Comments, Indentation, Keywords, Identifiers, I/O statements and Operators- Decision making Statements-Iterative Statements/Loops-**Functions**: Built-in functions and User-defined functions-Arguments passing techniques and Return values-Default arguments-Keyword arguments-Lambda function.	**12**	**CO1**
2	**Data Structures**: Lists, Tuples, Sets, Dictionaries and Strings-**Exception Handling**: try, except, else and finally keywords, built-in exceptions and customized exceptions.	**12**	**CO2**
3	**File Handling**: Creation, reading and writing file contents- **Modules**: import statement, built-in modules and user-defined modules-**Numpy**: Creation and manipulation of 1-D and multidimensional arrays, functions and operators for arrays-**Scipy**: optimize, linear algebra and statistics sub packages-**Interfacing Python with**	**12**	**CO3**

	Database: MySQL Commands-Connecting MySQL with Python - Building an address book with features for addition, deletion, modification and selection of rows.		
4	**Object Oriented Programming**: Classes - Objects -Class methods- self argument-Constructor and Destructor-Class variables and Object variables- - Public and Private members- Inheritance and its types -super() function- **Polymorphism**: Operator overloading and Function Overloading. **Data Visualization in Python: Matplotlib library:** plot() function, Line chart, Bar chart, Pie chart and Scatter plot-**Seaborn library**: Box plot and Heatmap.	**12**	**CO4**
5	**Pandas:** Creation of Dataframe-Addition and deletion of rows/columns in dataframe-Import and export different types of files-Built in functions used in dataframe-**Data Extraction**: Slicing, Filtering using iloc, loc, query and operators-Sorting of dataframe-Group by functionality-**Handling missing values**: Finding the missing values and data imputation.	**12**	**CO5**

Text Books:

1. Bharti Motwani, "**Data Analytics with Python**", First Edition, O'Reilly, 2020.
2. Vamsi Kurama, "**Python Programming: A Modern Approach**", Pearson Education, 2019.
3. Allen B. Downey, "**Think Python: How to Think Like a Computer Scientist**", O'Reilly, 2015.

Reference Books:

1. Pooja Sharma, "**Programming in Python**", BPB Publications, 2017.
2. R. Nageswara Rao, "**Core Python Programming**", 2nd Edition, Dreamtech, 2017.
3. A. Martelli, A. Ravenscroft, S. Holden, "**Python in a Nutshell**", O'Reilly, 2009.

E-References:

1. https://nptel.ac.in/courses/106/106/106106182/
2. https://nptel.ac.in/courses/106/106/106106145/
3. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs36/
4. https://www.tutorialspoint.com/python/
5. https://www.udacity.com/course/introduction-to-python

DEPARTMENT OF MCA

SECOND SEMESTER

CORE COURSE VI: FULL STACK WEB DEVELOPMENT

Course Code	**: 2529209**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *Understand the fundamental concepts of web development, including frontend, backend, and database integration.*
- *To learn the basics of JavaScript*
- *Develop interactive web applications using JavaScript, React.js, and Node.js.*
- *Build and manage RESTful APIs using Express.js and integrate them with a MongoDB database.*
- *Implement state management, routing, and form handling in React for dynamic user interfaces.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Explain the fundamental web development framework and apply JavaScript programming concepts for building interactive web applications.
CO2	Develop backend applications using Node.js, manage dependencies with NPM, and handle asynchronous operations using events and callbacks.
CO3	Build and configure RESTful APIs using Express.js and integrate them with frontend applications using JSON-based data exchange.
CO4	Develop dynamic and interactive user interfaces using React.js, including state management, form handling, and routing.
CO5	Implement MongoDB database operations, integrate it with Express.js
CO6	Design, develop, and deploy a full-stack web application using JavaScript, Node.js, Express.js, React.js, and MongoDB while integrating frontend, backend, and database functionalities

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	2	2	1	2	3	2	3	3	1
CO2	2	3	2	1	2	3	2	3	3	1
CO3	2	3	2	1	2	3	2	3	3	1
CO4	2	3	2	1	2	3	2	3	3	1
CO5	2	3	2	1	2	3	2	3	3	1
CO6	3	3	3	2	3	3	3	3	3	2

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Understanding the Basic Web Development Framework-** User-Browser-Webserver-Backend Services, Understanding the Node.js-to-Angular Stack Components-Node.js-MongoDB-Express-Angular, JavaScript Primer: Defining Variables - Data Types - Operators - Looping - Functions - JavaScript Objects - Manipulation Strings - Working with Arrays -Error Handling.	**12**	**CO1, CO6**
2	**Getting Started with Node.js**-Understanding Node.js-Installing Node.js- Working with Node packages – Using Node package manager - Using Events, Listeners, Timers, and Callbacks in Node.js : Understanding the Node.js - Implementing Callbacks.	**12**	**CO2**

3	**Implementing Express in Node.js** - Configuring Routes - Using Requests Objects - Using Response Objects – Handling Data I/O in Node.js: Working with JSON - Implementing HTTP Services in Node.js - Introduction to React JS: React Elements- ReactDOM-React Components- React with JSX - React Fragments.	**12**	**CO3, CO6**
4	**React State Management:** Building a Simple CRUD App- UseState Hook -Building Forms – Enhancing Components with Hooks -Incorporating Data - React Router.	**12**	**CO4, CO6**
5	**Building the MongoDB Environment** - Administering Databases - Connecting to MongoDB from Node.js - Accessing and Manipulating Databases - Accessing MongoDB from Node.js - Integrating MongoDB with Express API - Deploying the Application.	**12**	**CO5, CO6**

Text Books:

1. Alex Banks, Eve Porcello, "**Learning React: Modern Patterns for Developing React Apps**", O'Reilly Media, 2020.
2. Brad Dayley , Brendan Dayley, Caleb Dayley, "**Node.Js, Mongodb and Angular Web Development: The Definitive Guide to Using the Mean Stack to Build Web Applications**", Addison-Wesley, Second Edition, 2018

Reference Books:

1. Vasan Subramanian, **"Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node"**, Second Edition, Apress, 2019.
2. Chris Northwood, **"The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer"**, 1st edition, Apress, 2018.
3. Kirupa Chinnathambi, **"Learning React: A Hands-On Guide to Building Web Applications Using React and Redux"**, 2nd edition, Addison-Wesley Professional, 2018.

E-References:

1. https://www.geeksforgeeks.org/react/
2. https://www.tutorialspoint.com/reactjs/index.htm
3. https://www.geeksforgeeks.org/nodejs/
4. https://www.mongodb.com/docs/manual/tutorial/

DEPARTMENT OF MCA

SECOND SEMESTER

CORE COURSE VII: DATA COMMUNICATION AND NETWORKS

Course Code	**: 2529210**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To make the student understand the concepts and fundamentals of data communication and computer networks.*
- *To know about the OSI reference model.*
- *To impart the functioning of different layers in OSI.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand knowledge of the principles and concepts of computer networks and the design of OSI layers.
CO2	Explore the insights into the Data Link Layer protocols
CO3	Demonstrate the function of Medium Access sub layer
CO4	Identify the design issues and solutions in the Network Layer
CO5	Describe the concepts of Transport Layer and Application Layerl

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2	-	2	3	3	2	1
CO2	3	2	2	2	-	2	3	3	2	1
CO3	3	2	2	2	-	2	3	3	2	1
CO4	3	2	2	2	-	2	3	3	2	1
CO5	3	2	2	2	-	2	3	3	2	1

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction**: Network Hardware – Network Software – Reference Models: OSI and TCP/IP models – **Physical layer**: Guided Transmission media–Wireless Transmission–Communication Satellites.	**12**	**CO1**
2	Digital Modulation and Multiplexing - **Switching**: Circuit and Packet switching. Data link layer: Design issues – error detection and correction, Elementary data link protocols – Sliding window protocols.	**12**	**CO2**
3	**Medium Access Sub Layer**: Channel Allocation Problem – Multiple Access Protocols: ALOHA– Carrier Sense Multiple Access Protocols – Collision Free Protocols – Limited Contention Protocols.	**12**	**CO3**
4	**Network layer**: design issues – Routing Algorithms: Shortest Path Routing – Flooding – Distance Vector Routing – Link State Routing – Congestion control algorithms: Approaches to congestion control- traffic aware routing-admission control-traffic throttling - load shedding.	**12**	**CO4**
5	**Transport layer**: Transport service - Elements of Transport Protocol -Internet Transport Protocol - **Application Layer**: Domain Name System - Electronic Mail - World Wide Web - Streaming Audio and Video - Content Delivery.	**12**	**CO5**

Text Book:

1. A.S. Tanenbaum, David J. Wetherall, and Nick Feamster, **"Computer Networks"**, 6th Edition, Pearson Education, 2021.

Reference Books:

1. James F. Kurose and Keith W. Ross**, "Computer Networking: A Top-Down Approach",** 6th Edition, Pearson Education, 2013.
2. Behrouz A. Forouzan**, "Data Communications and Networking",** 4th Edition, McGraw-Hill, 2007.

E-References:

1. https://www.javatpoint.com/computer-network-tutorial
2. https://www.geeksforgeeks.org/computer-network-tutorials/
3. https://www.guru99.com/data-communication-computer-network-tutorial.html

DEPARTMENT OF MCA

SECOND SEMESTER

DISCIPLINE SPECIFIC ELECTIVE 1: INFORMATION SECURITY PRINCIPLES

Course Code	**: 2529211 (A)**	**Credits**	**: 03**
L:T:P:S	**: 3:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To understand and apply the models of information security*
- *To study and analyze cryptographic and forensic methods*
- *Analyze and simulate the network and application security*
- *Explore the nature and logic behind security threats on the web as an ethical hacker*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Discuss the basics of information security
CO2	Illustrate the legal, ethical and professional issues in information security
CO3	Demonstrate the aspects of risk management.
CO4	Become aware of various standards in the Information Security System
CO5	Design and implementation of Security Techniques.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	2	2	1	-	2	2	2	2	3
CO2	2	2	2	2	-	2	2	2	2	3
CO3	2	2	2	2	-	2	2	2	2	3
CO4	2	2	2	2	-	2	2	2	2	3
CO5	3	3	3	2	2	3	3	3	3	3

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction**: History, what is Information Security? Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC	**9**	**CO1**
2	**Security Investigation**: Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies	**9**	**CO2**
3	**Security Analysis**: Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem	**9**	**CO3**
4	**Logical Design**: Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.	**9**	**CO4**
5	**Physical Design**: Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel	**9**	**CO5**

Text Books:

1. Michael E. Whitman and Herbert J. Mattord, **"Principles of Information Security"**, 7th Edition, Cengage Learning, 2021.

Reference Books:

1. Matt Bishop, "**Computer Security: Art and Science**", 2nd Edition, Pearson, 2018.
2. Micki Krause and Harold F. Tipton, "**Information Security Management Handbook**", 6th Edition, CRC Press, 2017.
3. Stuart McClure, Joel Scambray, and George Kurtz, "**Hacking Exposed: Network Security Secrets & Solutions**", 4th Edition, McGraw-Hill, 2003.

E-References:

1. http://williamstallings.com/Cybersecurity/
2. freecomputerbooks.com › compscspecialSecurityBooks

DEPARTMENT OF MCA

SECOND SEMESTER

DISCIPLINE SPECIFIC ELECTIVE 1: CYBER SECURITY

Course Code	**: 2529211 (B)**	**Credits**	**: 03**
L:T:P:S	**: 3:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To understand various types of cyber-attacks and cyber-crimes*
- *To learn threats and risks within context of the cyber security*
- *To have an overview of the cyber laws & concepts of cyber forensics*
- *To study the defensive techniques against these attacks*

Course Outcomes: At the end of the Course, the tudent will be able to:

CO1	Understand the importance of cybersecurity, shared responsibilities, and the types, architecture, and motivations of cybercrime.
CO2	Identify and explain various forms of cybercrime and their impact on individuals and organizations.
CO3	Understand the concepts, components, and types of Intrusion Detection Systems (IDS).
CO4	Analyze different methodologies and technologies used in Intrusion Detection and Prevention Systems (IDPS).
CO5	Examine DDoS attacks, cyberwarfare concepts, and the role of cyber espionage and cyber weapons.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	1	2	2	2	2	2	3	3
CO2	3	3	2	2	2	2	2	2	2	3
CO3	2	2	3	3	1	2	3	2	2	2
CO4	2	2	2	3	1	2	3	3	2	2
CO5	3	3	2	3	2	3	2	3	3	3

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Overview of Cybersecurity**: CIA Triad (Confidentiality, Integrity, Availability) – Challenges of Computer security –Computer Security Terminologies- Threats Attacks and Assets - Fundamental Security design principles –- Security policy.	9	**CO1**
2	Cybersecurity Landscape - Various forms of Cybercrime: Cyber stalking – Intellectual property theft – Salami Attack – E-mail bombing – Phishing – Identity theft – Spoofing – Worms-Trojan Horses-Virus – DoS and DDoS – Defacement attacks – Ransomware.	9	**CO2**
3	**User Authentication**: Electronic User Authentication Model – Risk Assessment for user authentication - Password Based Authentication: Hashed Password and Password selection strategies – Token-based authentication - Biometric authentication - Remote user authentication - Security issues for authentication.	9	**CO3**
4	**DoS and DDoS:** Denial – of – Service Attacks – Source address spoofing – SYN Spoofing – Flooding attacks – Distributed Denial of Service attacks – Application – Based Bandwidth attacks – Reflector and amplifier attacks– Defenses against DoS Attacks.	9	**CO4**
5	**Intrusion**: Intruders - Intrusion Detection – Anomaly detection – Signature of Heuristic detection – Host-based Intrusion detection – Network – Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion detection Exchange format.	9	**CO5**

Text Books:

1. William Stallings, "**Computer Security: Principles and Practice**", 3rd Edition, Pearson Education, 2014. (Modules-1,3,4,5)
2. Rajesh Kumar Goutam, "**Cyber Security Fundamentals**", BPB Publications, 2021. (Modules-2)

Reference Books:

1. Mayank Bhusan, Rajkumar Singh Rathore, Aatif Jamshed, **"Fundamentals of Cyber Security: Principles, Theory and Practices"**, BPB Publishers, First Edition, 2017.
2. David Kim, Michael G. Solomon, **"Fundamentals of Information Systems Security"**, 3rd Edition, 2016.
3. Michael E. Whitman and Herbert J. Mattord, **"Principles of Information Security"**, Vikas Publishing House, New Delhi, 2003.

E-References:

1. https://nptel.ac.in/courses/106/106/106106129/
2. https://www.digitalocean.com/community/tech_talks/foundations-of- computer-security

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SECOND SEMESTER

DISCIPLINE SPECIFIC ELECTIVE I: ETHICAL HACKING

Course Code	**: 2529211 (C)**	**Credits**	**: 03**
L:T:P:S	**: 3:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To understand and analyze Information security threats and counter measures*
- *To perform security auditing & testing*
- *To understand issues relating to ethical hacking*
- *To study & employ network defense measures*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Identify the vulnerabilities/threats/attacks.
CO2	Describe penetration & security testing. Use tools to identify vulnerable entry points
CO3	Identify vulnerabilities using sniffers at different layers. Interpret safe penetration techniques on the World Wide Web.
CO4	Design a computer against a variety of security attacks using various tools. Handle web application vulnerabilities
CO5	Identify attacks in wireless networks and how to become a professional ethical hacker.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	1	2	3	1	2	3	1	2
CO2	3	1	2	3	1	2	3	1	2	3
CO3	1	2	3	1	2	3	1	2	3	1
CO4	2	3	1	2	3	1	2	3	1	2
CO5	3	1	2	3	1	2	3	1	2	3

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Ethical Hacking Overview & Vulnerabilities:** Understanding the importance of security-Concept of ethical hacking and essential Terminologies Threat- Attack- Vulnerabilities- Target of Evaluation- Exploit. Phases involved in hacking.	**9**	**CO1**
2	**Footprinting & Port Scanning**: Footprinting - Introduction to foot printing- Understanding the information gathering methodology of the hackers - Tools used for the reconnaissance phase. Port Scanning – Introduction - using port scanning tools - Ping sweeps - Scripting Enumeration - Introduction- Enumerating windows OS & Linux OS.	**9**	**CO2**
3	**System Hacking**: Aspect of remote password guessing- Role of eavesdropping - Various methods of password cracking- Keystroke Loggers - Understanding Sniffers Comprehending Active and Passive Sniffing - ARP Spoofing and Redirection- DNS and IP Sniffing - HTTPS Sniffing.	**9**	**CO3**
4	**Hacking Web Services & Session Hijacking**: Web application vulnerabilities - Application coding errors - SQL injection into Back-end Databases – Cross - site scripting – cross -Site request forging - Authentication bypass - Web services and related flaws - Protective http headers Understanding Session Hijacking - Phases	**9**	**CO4**

	involved in Session Hijacking - Types of Session Hijacking - Session Hijacking Tools.		
5	**Hacking Wireless Networks:** Introduction to 802.11 - Role of WEP - Cracking WEP Keys - Sniffing Traffic Wireless DOS attacks – WLAN Scanners – LAN Sniffers – Hacking Tools - Securing Wireless Networks.	**9**	**CO5**

Text Books:

1. Omar Santos and Michael Gregg, **"Certified Ethical Hacker (CEH) Version 10 Cert Guide"**, Pearson Education, India, 2019.
2. Michael T. Simpson, Nicholas Antill, and Robert S. Wilson, **"Hands-On Ethical Hacking and Network Defense"**, 4th Edition, Cengage Learning, 2023.

Reference Books:

1. Patrick Engebretson, "**The Basics of Hacking and Penetration Testing - Ethical Hacking and Penetration Testing Made Easy**", Syngress Media, Second Revised Edition, 2013.
2. Ramachandran V, "**Wireless Penetration Testing Beginner's Guide**", 3rd Edition, Packt Publishing, 2011.
3. Rajat Khare, "**Network Security and Ethical Hacking**", Luniver Press, 2006.
4. Thomas Mathew, "**Ethical Hacking**", OSB Publishers, 2003.

E-References:

1. https://www.elsevier.com/books/
2. https://www.elsevier.com/books/cyber-security-awareness-forlawyers
3. https://books.google.co.in/books
4. https://www.coursera.org/specializations/ethical-hacking
5. https://nptel.ac.in/courses

DEPARTMENT OF MCA

SECOND SEMESTER

CORE PRACTICAL III: ADVANCED PYTHON PROGRAMMING LAB

Course Code	**: 2529212**	**Credits**	**: 03**
L:T:P:S	**: 1:0:4:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 50**

Learning Objectives:

- *Master the fundamentals of writing Python scripts*
- *Learn core Python scripting elements such as variables and flow control structures*
- *Discover how to work with lists and sequence data*
- *Write Python functions to facilitate code reuse*
- *Use Python to read and write files*
- *Make their code robust by handling errors and exceptions properly*
- *Work with the Python standard library*
- *Explore Python's object-oriented features*

Lab Exercises:

1. Data types in Python
2. Operators in Python
3. Conditional Statements
4. Iterative Statements
5. Functions
6. Modules
7. String Operations
8. List Operations
9. Tuple Operations
10. Dictionary Operations
11. Set Operations
12. Class and Objects
13. Inheritance
14. Exception Handling
15. File Operations
16. Python with MySQL
17. Working with MatPlotLib for plotting charts and graphs
18. Working with NumPy
19. Working with Scipy
20. Working with Pandas

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SECOND SEMESTER

CORE PRACTICAL IV: FULL STACK WEB DEVELOPMENT LAB

Course Code	**: 2529213**	**Credits**	**: 03**
L:T:P:S	**: 1:0:4:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 50**

Learning Objectives:

- *Develop interactive web applications using JavaScript, React.js, Node.js, and Express.js.*
- *Implement backend services, create RESTful APIs, and integrate them with a MongoDB database.*
- *Perform CRUD operations in a full-stack application and test its functionality.*

Lab Exercises:

1. Design a form and implement java script showing all the major form validations.
2. JavaScript program illustrating the Date and Math Objects
3. JavaScript program to handle different events.
4. Create a Node.js program that reads a file and prints its content.
5. Create an Express API with GET /students that returns a list of students in JSON format.
6. Write a program to create a simple calculator Application using React JS
7. Write a program to create a voting application using React JS
8. Create a counter using ReactJS
9. Create a Todo application using ReactJS.
10. Write a server side program for Accessing MongoDB from Node.js.
11. Perform CRUD operations (Insert, Read, Update, Delete) on MongoDB using Node.js.
12. Project: Deploy a simple full-stack app with a React frontend and an Express/MongoDB backend.

DEPARTMENT OF MCA

SECOND SEMESTER

SOFT SKILLS-II: APTITUDE TRAINING I

Course Code	**: 2550208**	**Credits**	**: 02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 1.5**	**ESE Marks**	**: 50**

Module – I: Number Systems - LCM and HCF - Decimal Fractions - Square Roots and Cube Roots -Average – Problems on Ages.

Module – II: - Simple Interest and Compound Interest - Profit and Loss - Linear Equations - Areas and Volumes – Quadratic Equations.

Module – III: Time, Speed and Distance - Problems on Trains, Boats & Streams - Height and Distance - Probability - Permutation & Combination – Calendar and Clocks.

Reference Books:

1. R.S. Aggarwal, "**Quantitative Aptitude for Competitive Examinations**", S Chand Publisher, 20th edition 2013.
2. Arun Sharma, "**How to Prepare for Quantitative Aptitude for the CAT**", Mcgraw Hill Education, 6 th Edition, 2019.
3. Abhijit Guha, "**Quantitative Aptitude for Competitive Examinations**", Mcgraw Hill Education, 5th Edition, 2014.
4. R.V Praveen, "**Quantitative Aptitude and Reasoning**", PHI, 2nd Edition , 2013.

E-References:

1. http://www.indiabix.com
2. http://www.geeksforgeeks.com
3. http://www.examveda.com
4. http://www.javatpoint.com
5. http://www.aptitudeschool.com

DEPARTMENT OF MCA

SECOND SEMESTER

SKILL ENCHANCEMENT COURSE-DISPCIPLINE SPECIFIC I: SOFTWARE ENGINEERING

Course Code	**: 2529214**	**Credits**	**: 03**
L:T:P:S	**: 3:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 1.5**	**ESE Marks**	**: 50**

Learning Objectives:

1. ***Understand software engineering principles****: Students will understand the fundamental principles of software engineering, including modularity, abstraction, and reuse.*
2. ***Apply software development life cycle****: Students will learn to apply the software development life cycle, including planning, analysis, design, implementation, testing, and maintenance.*
3. ***Design and develop software systems****: Students will learn to design and develop software systems using various programming languages and software development tools.*
4. ***Test and validate software systems****: Students will learn to test and validate software systems using various testing techniques, including unit testing, integration testing, and user acceptance testing.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Explain the problem domain to choose process models and to develop SRS
CO2	Implement the agile in the project development
CO3	Summarize the model software projects using appropriate design notations
CO4	Show the measure the product and process performance using various metrics
CO5	Evaluate the system with various testing techniques and strategies

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2	2	2	3	3	2	2
CO2	3	3	3	2	3	2	3	3	2	2
CO3	3	2	3	2	3	2	3	3	2	2
CO4	2	2	2	2	2	2	2	2	2	2
CO5	3	3	3	3	3	3	3	3	3	3

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Software Engineering:** The Software Process-Software Development Myths-Software Process Structure - Process Models -The Waterfall Model - Incremental Process Models- Evolutionary Process Models - Concurrent Models. Specialized Process Models- Component-Based Development-	**9**	**CO1**
2	**Agile Development:** Agility Principles- The Politics of Agile Development- The XP Process- Industrial XP- Scrum - Dynamic Systems Development Method- Agile Modeling- Agile Unified Process. Modelling – Class Based methods – behavior, patterns and web/mobile apps	**9**	**CO2**
3	**Modeling**: Web app design quality – design goals – webapp interface design – aesthic design- content design- navigation design. Mobile app design: Devolping Mobile Apps – mobile app design best practices.	**9**	**CO3**
4	**Quality Concepts:** Software Quality - Review Metrics and Their Use - Informal Reviews -	**9**	**CO4**

	Formal Technical Reviews - Post-Mortem Evaluations - Elements of Software Quality Assurance - SQA Tasks, Goals, and Metric.		
5	**Software Testing Strategies -Testing Web Applications** - Testing Concepts for WebApps - Content Testing - User Interface Testing - Component-Level Testing - Navigation Testing - Configuration Testing - Performance Testing.	**9**	**CO5**

Text Books:

1. Roger S. Pressman, "**Software Engineering: A Practitioner Approach**", TMH, International Edition, Eighth Edition, 2015.
2. Richard Fairley, "**Software Engineering Concepts**", TMH, Third Edition, 2018.

Reference Books:

1. David Farley, **"Modern Software Engineering: Doing What Works to Build"**, TMH, First Edition, 2021.
2. Sommerville, **"Software Engineering"**, Pearson India, New Delhi, Tenth Edition, 2016.
3. Ali Behforroz, Frederick J. Hudson, **"Software Engineering Fundamentals"**, Oxford Indian Reprint, First Edition, 2012.
4. Pankaj Jalote, **"An Integrated Approach to Software Engineering"**, Narosa Publications, Third Edition, 2011.

E-References:

1. https://www.geeksforgeeks.org/software-engineering-introduction-to-software-engineering/
2. https://archive.nptel.ac.in/courses/106/101/106101061/
3. https://ocw.mit.edu/courses/16-355j-software-engineering-concepts-fall-2005/pages/lecture-notes/
4. https://www.cs.cornell.edu/courses/cs5150/2020sp/lectures.html
5. https://www.youtube.com/playlist?list=PL_pbwdIyffslgxMVyXhnHiSn_EWTvx1G-

********End of Second Semester********

DEPARTMENT OF MCA

THIRD SEMESTER

CORE COURSE VIII: BIG DATA FRAMEWORKS

Course Code	**: 2529315**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

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Learning Objectives:

- *Understand the fundamentals of Big Data and the Hadoop ecosystem, for efficient large-scale data storage and processing.*
- *Learn the principles of NoSQL databases, their types, advantages, and the use of MongoDB for handling unstructured and semi-structured data.*
- *Gain proficiency in Hive for data warehousing and SQL-based querying, including partitioning, bucketing, and user-defined functions.*
- *Explore Apache Spark's architecture, DataFrames, and Spark SQL to perform efficient big data analytics.*
- *Apply advanced Spark techniques, including integrating external data sources and implementing machine learning models using Spark MLlib.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Demonstrate an understanding of Big Data characteristics, storage mechanisms, and Hadoop's distributed processing capabilities.
CO2	Apply NoSQL database concepts to design, query, and manage data efficiently using MongoDB.
CO3	Develop Hive queries for structured data processing and optimize query performance using advanced Hive features.
CO4	Implement Spark-based big data applications using DataFrames, Spark SQL, and structured APIs for efficient data handling.
CO5	Analyze large datasets using Spark MLlib by implementing machine learning models for classification and regression.
CO6	Develop expertise in handling, processing, and analyzing large-scale datasets by leveraging Hadoop, NoSQL databases, Hive, and Apache Spark, enabling efficient big data management, SQL-based querying, real-time processing, and machine learning model implementation.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	1	2	3	1	2	3	1	2
CO2	3	1	2	3	1	2	3	1	2	3
CO3	1	2	3	1	2	3	1	2	3	1
CO4	2	3	1	2	3	1	2	3	1	2
CO5	3	1	2	3	1	2	3	1	2	3
CO6	1	2	3	1	2	3	1	2	3	1

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Understanding Big Data & Hadoop Ecosystem:** Understanding Big Data – Classification of Digital Data – Evolution of Big Data – Definition and Challenges of Big Data – Characteristics of Big Data – Need for Big Data Frameworks – Hadoop Ecosystem – Hadoop Distributed File System – HDFS Architecture - Anatomy of File	**12**	**CO1, CO6**

	Read – Anatomy of File Write – HDFS Commands – MapReduce – Limitations of MapReduce – Advantages of Apache Spark Over MapReduce.		
2	**Introduction to NoSQL:** NoSQL – Types of NoSQL Databases – Why NoSQL? – Advantages of NoSQL – Use of NoSQL in Industry – SQL vs NoSQL – Types of NoSQL Data Models – Schema-less Databases – Materialized Views – Sharding – Replication – Master-Slave Replication – Peer-Peer Replication – MongoDB – Why MongoDB? – Data Types in MongoDB – MongoDB Query Language.	**12**	**CO2**
3	**Hive & Introduction to Spark:** Introduction to Hive – Hive Features – Hive Architecture – Hive Data Types – Built-in Functions in Hive – Hive Query Language (HQL) – DDL Statements – DML Statements – Database – Tables – Partitioning – Bucketing – Views – Sub-Query – Joins – Aggregation – Group By and Having – User-Defined Functions – Introduction to Apache Spark – Spark Components – Apache Spark Architecture – Spark Application and SparkSession – Transformations, Actions, and Lazy Evaluation – The Spark UI – RDD.	**12**	**CO3, CO6**
4	**Spark SQL & DataFrames:** Introduction to Apache Spark's Structured APIs – The DataFrame API – Spark's Basic Data Types – Spark's Structured and Complex Data Types – Schemas and Creating DataFrames – Columns and Expressions – Rows – Common DataFrame Operations – DataFrames vs. Datasets – Spark SQL and the Underlying Engine – Using Spark SQL in Spark Applications – Basic Query Examples – SQL Tables and Views: Managed vs. Unmanaged Tables – Creating SQL Databases and Tables – Creating Views – Viewing Metadata – Caching SQL Tables – Reading Tables into DataFrames.	**12**	**CO4, CO6**
5	**Advanced Spark – External Integrations & MLlib:** Data Sources for DataFrames and SQL Tables: DataFrameReader – DataFrameWriter – Parquet – JSON – CSV – Avro – ORC – Images – Binary Files – External Data Sources – Working with Hive Tables – Higher-Order Functions in DataFrames and Spark SQL – Common DataFrames and Spark SQL Operations: Unions – Joins – Windowing – Modifications – Introduction to Spark MLlib – Extracting, Transforming, and Selecting Features – ML Pipelines – Machine Learning Regression and Classification.	**12**	**CO5, CO6**

Text Books:

1. Seema Acharya, Subhashini Chellappan, "**Big Data Analysis**", Second Edition, Wiley, 2019.
2. DT Editorial Services, "**Black Book- Big Data (Covers Hadoop 2, MapReduce, Hive, Yarn, Pig, R, Data Visualization)**", Dream tech Press Edition 2017.
3. Jules S. Damji, Brooke Wenig, Tathagata Das, and Denny Lee,"**Learning Spark Lightning-Fast Data Analytic**s" Second Edition, 2020.

Reference Books:

1. Tom White, "**Hadoop: The Definitive Guide**", O'Reilly Media, Inc., Fourth Edition, 2015
2. Thomas Erl, Wajid Khattak, and Paul Buhler, "**Big Data Fundamentals: Concepts, Drivers & Techniques**, Pearson India Education Service Pvt. Ltd., First Edition, 2016
3. Tomasz Drabos, "Learning PySpark", PACKT, 2017
4. Holden Karau, "Learning Spark". PACKT, 2016.

E-References:

1. https://www.tutorialspoint.com/big_data_analytics/index.htm
2. https://data-flair.training/blogs/big-data-tutorials-home/
3. https://www.datacamp.com/tutorial/pyspark-tutorial-getting-started-with-pyspark
4. https://www.tpointtech.com/apache-spark-tutorial

DEPARTMENT OF MCA

THIRD SEMESTER

CORE COURSE IX: MOBILE APPLICATION DEVELOPMENT

Course Code	**: 2529316**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To introduce Android platform and its architecture.*
- *To learn activity creation and Android UI designing.*
- *To be familiarized with Intent, Broadcast receivers and Internet services.*
- *To work with SQLite Database and content providers.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Define Android applications, download and install Android Studio, work in development environment and to execute the First Android Application. Illustrate the use of activities, fragments and intents in Android to invoke Built-in Applications and use of notification in Android.
CO2	Design and implement the user interfaces using basic widgets, views, view groups and layouts of Android.
CO3	Work with user interface to handle pictures and menus and explain data storage options using the internal and external storage using Shared Preferences, files, SQLite database and Content Providers.
CO4	Illustrate the formation of SMS and E-mail in the mobile phones and demonstrate the Location Based Services (LBS) and consumption of Web Services in Android using JSON and Sockets.
CO5	Developing Android Services by establishing communication between a service and an activity and illustrating the steps for publishing Android applications.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	2	3	2	1	2	1	2
CO2	3	2	2	3	2	2	3	1	3	3
CO3	1	1	3	2	1	3	1	1	3	1
CO4	3	3	1	1	3	1	2	3	2	1
CO5	2	1	1	3	2	2	2	1	2	2

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	Introduction to Android – Features of Android-Architecture of Android-Obtaining the Required Tools- Creating First Android Application - Anatomy of Android Application-Components of Android Application-Lifecycle of Activity. **Intents**: Creating Intents, Types of Intents, Intents returning result, Intent Filters, Calling Built–In Application Using Intents and Displaying Notifications using PendingIntent. **Fragments**: Lifecycle of Fragment, Types of Fragments and how to create and use fragments.	**12**	**CO1**
2	**Screen Layouts:** Linear, Table, Relative, Absolute and Grid. **Basic Views:** Toast**,** TextView**,** EditText, Button, AutoCompleteTextView, CheckBox, ToggleButton, ImageButton, RadioButton, SeekBar, ListView, ImageView, DatePicker and TimePicker- Adapting to Display Orientation - Creating the views programmatically.	**12**	**CO2**
3	**Menus**: OptionsMenu, ContextMenu and PopupMenu. **Data Persistence:** Saving and	**12**	**CO3**

	Loading using Shared Preferences - Persisting Data to Files - **SQLite Database**: Create, Insert, Delete, Update and Select queries. **Content Provider:** Creating and using Content Provider.		
4	Sending SMS - Sending E-Mail- **Location – Based Services:** Displaying Maps - Getting Location Data**. Networking:** Consuming Web Services Using HTTP - Consuming JSON Services - Sockets Programming.	**12**	**CO4**
5	**Developing Android Services:** Lifecycle of Service, Types of service and Creating own services. **Threading**: Worker thread and Async thread. **Publishing Android Applications:** Preparing for Publishing - Deploying APK Files.	**12**	**CO5**

Text Book:

1. DiMarzio, Jerome F.,"**Beginning Android Programming with Android Studio**", 4th ed., Wiley, 2016.

Reference Books:

1. Rick Boyer, **"Android 9 Development Cookbook"**, 3rd Edition, Packt Publishing, 2018.
2. Wei Meng Lee, **"Beginning Android 4 Application Development"**, Wiley Publications, 2013.
3. Anubhav Pradhan, Anil V Deshpande, 'Mobile Applications Development', First Edition.
4. Barry Burd 'Android Applications Development all in one for Dummies", First Edition.
5. "Teach Your self Android Application Development in 24 hours" First Edition, SAMS.
6. Reto Meier and Ian Lake, **"Professional Android",** 4th Edition, Wiley Publishers.

E-References:

1. http://developer.android.com/
2. https://www.tutorialspoint.com/android/index.htm
3. https://abhiandroid.com/

DEPARTMENT OF MCA

THIRD SEMESTER

CORE COURSE X: MACHINE LEARNING

Course Code	**: 2529317**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To understand the concept of Machine Learning fundamentals.*
- *To understand the strengths and weaknesses of many popular machine learning approaches.*
- *Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.*
- *Be able to design and implement various machine learning algorithms in a range of real-world applications.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Interpret basic concepts and techniques of machine learning
CO2	Recognize the need of regression model
CO3	Elaborate Decision tree techniques
CO4	Learn the concepts in Bayesian analysis from probability models and methods
CO5	Describe various clustering techniques.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	1	2	3	2	2	3	2	2
CO2	2	1	3	3	2	1	3	2	1	3
CO3	1	3	2	1	1	3	1	1	3	2
CO4	2	2	1	1	3	1	2	3	1	1
CO5	3	1	3	2	1	2	3	1	2	3

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction to Machine Learning**: Definition of machine learning, Types of Machine Learning, Applications of Machine Learning. Data Pre-processing: Data Cleaning, Data Integration, Data Transformation, Dimensionality Reduction.	**12**	**CO1**
2	**Linear Regression**: Introduction to supervised learning and regression, Statistical Relation between Two variables and Scatter Plots, Steps to Establish a Linear Regression, Evaluation of Model Estimators. **Logistic Regression**: Introduction to Logistic Regression, Building Logistic Regression Model, Maximum Likelihood Estimation.	**12**	**CO2**
3	**Decision Tree**: Introduction to Classification and Decision tree, Basic Decision Tree learning Algorithms -Attribute Selection Measures, ID3, Steps to construct Decision tree, Issues in Decision trees, Rule-based Classification, Pruning the rule set.	**12**	**CO3**
4	**Bayesian Classification**: Introduction to Bayesian Classifiers -Bayes Theorem, Naïve Bayes classifier, Bayesian Belief Networks, k-Nearest Neighbor (KNN), Measuring classifier Accuracy.	**12**	**CO4**
5	**Introduction to Unsupervised Learning Algorithms**: Introduction to Clustering-	**12**	**CO5**

	Applications of clustering, Requirements of Clustering, Types of Clustering, Partitioning Methods of Clustering-k-Means algorithm, Hierarchical Method- Agglomerative Algorithm.		

Text Book:

1. Anuradha Srinivasaraghavan, Vincy Joseph," **Machine Learning**", Wiley, 2019.

Reference Books:

1. Ulisses Braga-Neto., "**Fundamentals of Pattern Recognition and Machine Learning**" (2nd Edition). Springer, 2024.
2. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, "**Machine Learning**", 2019.
3. Marco Gori , "**Machine Learning: A Constraint-Based Approach**", Morgan Kaufmann. 2017
4. Ethem Alpaydin, "**Machine Learning: The New AI**", MIT Press-2016

E-References:

1. https://nptel.ac.in/courses/106/105/106105152/
2. http://www.cs.cmu.edu/~tom/mlbook.html
3. https://www.cs.cmu.edu/~hn1/tex/machine-learning/notes.pdf
4. https://www.javatpoint.com/machine-learning

DEPARTMENT OF MCA

THIRD SEMESTER

DISCIPLINE SPECIFIC ELECTIVE II: ESSENTIALS OF IOT SYSTEMS

Course Code	**: 2529318 (A)**	**Credits**	**: 03**
L:T:P:S	**: 3:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *To understand the fundamentals of Internet of Things*
- *To learn about the basics of IOT protocols*
- *To build a small low cost embedded system using RaspberryPi.*
- *To apply the concept of Internet of Things in the real world scenario*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Interpret the vision of IoT from a global context
CO2	Describe the fundamentals of IoT and M2M
CO3	Analyze applications of IoT in Raspberry PI
CO4	Appreciate the role of big data, cloud computing and data analytics in a typical IoT system
CO5	Determine the market perspective of IoT and illustrate the application of IoT in Industrial Automation and identify Real World Design Constraints.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	3	1	2	3	1	1	3	2	1
CO2	3	2	2	3	2	2	3	2	2	3
CO3	2	1	3	2	1	3	2	1	3	2
CO4	1	3	2	1	3	2	2	3	2	2
CO5	3	1	1	3	1	1	3	1	1	3

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction:** Physical Design of IoT- Logical Design of IoT- IoT Enabling Technologies - IoT Levels & Deployment Templates.	**9**	**CO1**
2	**IOT and M2M** : M2M – Difference between IoT and M2M-SDN and NFV for IoT – Need for IoT System Management – Simple Network Management Protocol (SNMP)-NETCONF - YANG - IoT System Management with NETCONF-YANG.	**9**	**CO2**
3	**IoT Platforms Design Methodology**: Ten steps in IoT design methodology- IoT Physical Devices & Endpoints: Basic building blocks of IoT device – Exemplary device: Raspberry Pi – Linux on Raspberry Pi – Raspberry Pi Interfaces – Programming Raspberry Pi with Python.	**9**	**CO3**
4	**IoT Physical Servers and Cloud Offerings**: Introduction to Cloud storage models and Communication APIs – WAMP-AutoBahn for IoT – Xively Cloud for IoT – Python Web Application Framework -DJANGO — Amazon Web Services for IoT – Amazon EC2 – Amazon AutoScaling – Amazon S3 – AmazonRDS – Amazon DynamoDB	**9**	**CO4**
5	**Case Studies and Real-World IoT Applications**: Home Automation - Smart Cities-Smart Grid-Smart Healthcare – Smart irrigation System.	**9**	**CO5**

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, "**Internet of Things: A Hands-on Approach**" , First Edition, Universities Press, 2023 (Reprint)
2. Raj Kamal, "**Internet of Things- Architecture and Design Principles**", First Edition, Mc-Graw Hill, 2017.

Reference Books:

1. Jeeva Jose , "Internet of Things",Khanna Publishing House,2023.
2. Ammar Rayes, Samere Salam,"**Internet of Things – From Hype to Reality**", First Edition, Springer Publishers, 2017.
3. Agus Kurniawan, "**Smart Internet of Things Projects**", First Edition, Packt Publishing Ltd., 2016.
4. Olivier Hersent, David Boswarthick, Omar Elloumi ,"**The Internet of Things – Key applications and Protocols**", Wiley, 2012.
5. Honbo Zhou, "**The Internet of Things in the Cloud: A Middleware Perspective**", CRC Press, 2012.
6. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "**Architecting the Internet of Things**", Springer, 2011.

E-References:

1. https://www.javatpoint.com/iot-internet-of-things/
2. https://www.edureka.co/blog/iot-tutorial/
3. https://www.tpointtech.com/iot-internet-of-things

DEPARTMENT OF MCA

THIRD SEMESTER

DISCIPLINE SPECIFIC ELECTIVE II: BLOCKCHAIN AND CRYPTOCURRENCY

Course Code	**: 2529318 (B)**	**Credits**	**: 03**
L:T:P:S	**: 3:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- *Understand how blockchain systems (mainly Bitcoin and Ethereum) work.*
- *To securely interact with them.*
- *Design, build, and deploy smart contracts and distributed applications.*
- *Integrate ideas from blockchain technology into their own projects.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Understand the basic of Cryptography and arrangement of components in a Blockchain.
CO2	Identify the insights of various consensus algorithms and crypto currency domain with Bitcoin as an example.
CO3	Demonstrate the Ethereum platform and its elements
CO4	Apply hyperledger Fabric to implement the Block chain Application.
CO5	Discuss the various application areas of Blockchain like smart contracts, DApp etc

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	3	1	2	3	2	2	3	1	1
CO2	3	2	2	3	2	1	3	2	2	3
CO3	1	1	3	2	1	3	2	1	3	2
CO4	2	3	2	1	3	1	1	3	2	1
CO5	3	1	1	3	1	2	3	1	1	3

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Cryptography:** Hash function, private key and public key-**Blockchain Basics:** Definition of Blockchain-Centralized vs Decentralized systems- Advantages and limitations of Blockchain- -Elements of a blockchain-Layers of blockchain-**Types of Blockchain**: Public, Private, Hybrid and Consortium Blockchains- Properties of Blockchain Solutions-Structure and construction of a Merkle Tree.	**9**	**CO1**
2	Byzantine's General Problem-**Distributed Consensus Algorithms**: Need of the algorithms, **Examples of algorithms**: PoW and PoS-**Cryptocurrency**: Properties, advantages and limitations-**Wallet**: Features and types of wallets. **BitCoin:** Introduction-The Bitcoin Block Structure-Genesis Block-The Bitcoin Network-Bitcoin Transactions-Block Propagation-Full Nodes vs SPVs.	**9**	**CO2**
3	**Ethereum:** Introduction -Ethereum accounts-Tries in Ethereum-Merkle Patricia Tree - Ethereum Transaction Structure- Ethereum Message Structure-Ethereum State Transaction Function-Gas Cost and Transaction Cost- -**Ethereum Virtual Machine (EVM)**: Architecture and working of EVM.	**9**	**CO3**

4	**Hyperledger:** Introduction-Advantages and limitations of Hyperledger-Properties of Hyperledger fabric-Hyperledger architecture-Hyperledger Transactions -Consensus in Hyperledger-Hyperledger tools-Hyperledger components.	**9**	**CO4**
5	**Smart contracts**: Working of smart contract, types of smart contract, role of smart contract and advantages of smart contract-Decentralized Applications (Dapp)-**Applications of Blockchain**: Government, Finance and Banking, Logistics, Healthcare and Supply chain management,	**9**	**CO5**

Text Books:

1. I.A. Dhotre," **Cryptocurrency and Blockchain Technologies**", First Edition, Technical Publications, August 2025.
2. Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, "**Blockchain Technology**", 2020, University Press.

Reference Books:

1. B. Singhal & G. Dhameja,"**Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions**", First Edition, Apress 2018.
2. Bashir, Imran," Mastering **Blockchain: Deeper Insights Into Decentralization, Cryptography, Bitcoin, and Popular Blockchain Frameworks**",2017.

E-References:

1. https://www.tutorialspoint.com/blockchain/index.htm
2. https://www.javatpoint.com/blockchain-tutorial
3. https://nptel.ac.in/courses/106/105/106105184/
4. https://onlinecourses.nptel.ac.in/noc20_cs01/preview

EPARTMENT OF MCA

THIRD SEMESTER

DISCIPLINE SPECIFIC ELECTIVE II: PRINCIPLES OF CLOUD COMPUTING

Course Code	**: 2529318 (C)**	**Credits**	**: 03**
L:T:P:S	**: 3:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 100**

Learning Objectives:

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To understand the concept of Virtualization and design of cloud Services
- To have knowledge on the various issues in cloud computing
- To understand the usage of cloud in various applications.

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	Understand the core concepts of the cloud computing paradigm: Evolution, need, advantages, limitations and factors that affect cloud computing.
CO2	Analyze the difference between grid and cloud architecture, different service models and deployment models
CO3	Develop the ability to understand virtualization technology used in cloud
CO4	Gain knowledge of various security techniques used in cloud computing
CO5	Analyze the importance of cloud in various applications

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	2	2	1	3	2	2	3	1	2
CO2	3	2	2	3	1	1	3	2	2	3
CO3	2	2	3	1	1	3	2	1	3	1
CO4	2	3	1	2	3	1	1	3	1	2
CO5	1	1	2	3	2	2	3	1	2	3

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	**Overview of Cloud Computing:** Introduction – Essentials of Cloud Computing – Needs of Cloud Computing- History of Cloud Computing- Benefits of Cloud Computing – Limitations of Cloud Computing- Vendors of Cloud Computing.	**9**	**CO1**
2	**Cloud Computing Architecture**: Introduction- Grid architecture- Cloud Computing Architecture –Similarities and differences between grid and cloud computing- Characteristics of Cloud Computing. Models of cloud computing – Cloud service models – cloud computing sub services models- cloud deployment models.	**9**	**CO2**
3	**Cloud data center**: Introduction – Cloud data center elements – storage network technologies. **Virtualization Technology**: Introduction – virtualization reference model – advantages of virtualization- server/compute virtualization – Need and advantage of Server/compute virtualization- Techniques of server/compute virtualization- types of virtualization.	**9**	**CO3**
4	**Security issues of cloud computing:** Introduction – security concerns of cloud computing – cloud information security objectives- cloud security design principles – cloud security services – secure cloud software testing.	**9**	**CO4**

5	**Advanced technologies in cloud computing:** Mobile cloud computing – Green Computing – Bigtable – Cloud usage for big data analytics and IoT. **Case Studies:** Cloud for Healthcare – Cloud for Education - Cloud for transportation systems- Live video streaming APP.	**9**	**CO5**

Text Books:

1. Shailendra Singh, "**Cloud Computing**", Oxford University Press,2018.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "**Distributed and Cloud Computing, From Parallel Processing to the Internet of Things**", Morgan Kaufmann Publishers, 2012

Reference Books:

1. Dan C. Marinescu, "**Cloud Computing: Theory and Practice**" (3rd Edition). Elsevier, 2024.
2. Barrie Sosinsky," **Cloud Computing Bible**", Wiley Publishing Inc, 2013.
3. John W.Rittinghouse and James F.Ransome, "**Cloud Computing: Implementation, Management, and Security**", CRC Press, 2010.
4. Borko Furht · Armando Escalante, "**Handbook of Cloud Computing**", Springer, e-ISBN 978-1-4419-6524-0, DOI 10.1007/978-1-4419-6524-0.

E-References:

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://www.tutorialspoint.com/cloud_computing/index.html
3. https://www.guru99.com/cloud-computing-for-beginners.html
4. https://www.youtube.com/watch?v=LICA-ILkO4w

DEPARTMENT OF MCA

THIRD SEMESTER

CORE PRACTICAL V: BIG DATA FRAMEWORKS LAB

Course Code	**: 2529319**	**Credits**	**: 03**
L:T:P:S	**: 1:0:4:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 50**

Learning Objectives:

- *Gain practical experience in handling large datasets using Hadoop, HDFS, and MapReduce for distributed data storage and processing.*
- *Design, implement, and query NoSQL databases like MongoDB, focusing on data modeling, sharding, and replication..*
- *Perform data analysis using Hive Query Language (HQL) and Apache Spark, leveraging SQL-like operations and DataFrames.*
- *Implement machine learning models using Spark MLlib.*

Lab Exercises:

1. Store and retrieve a sample dataset in HDFS using basic HDFS commands.
2. Perform a file read and write operation in HDFS and analyze the process.
3. Implement a basic Word Count program using MapReduce.
4. Execute HDFS commands to explore file permissions and replication.
5. Create a MongoDB database and insert sample JSON data.
6. Perform CRUD operations (Create, Read, Update, Delete) on a MongoDB collection.
7. Implement sharding on a MongoDB collection and analyze the data distribution.
8. Set up master-slave replication in MongoDB and verify synchronization.
9. Create a Hive table and load data into it from a CSV file.
10. Execute Hive queries using built-in aggregate functions (SUM, COUNT, AVG).
11. Perform partitioning and bucketing in Hive and retrieve specific data.
12. Implement different types of joins in Hive on two datasets.
13. Create an RDD in Spark and perform basic transformations and actions.
14. Create a DataFrame from a CSV file and explore its schema.
15. Perform filtering, sorting, and grouping operations on a DataFrame.
16. Use Spark SQL to create a managed and an unmanaged table, then query them.
17. Implement windowing functions in Spark SQL on a dataset.
18. Load and save DataFrames using different formats (CSV, JSON, Parquet, Avro).
19. Perform join operations on two DataFrames using Spark SQL.
20. Apply higher-order functions (map, filter) on DataFrames.
21. Train a simple classification model using Spark MLlib.

DEPARTMENT OF MCA

THIRD SEMESTER

CORE PRACTICAL VI: MOBILE APPLICATION DEVELOPMENT LAB

Course Code	**: 2529320**	**Credits**	**: 03**
L:T:P:S	**: 1:0:4:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 50**

Learning Objectives:

- *Describe the platforms upon which the Android OS will run.*
- *Create simple applications that runs under Android OS*
- *Access and work with the Android file system*
- *Define and access with databases under Android OS*

Lab Exercises:

1. Activity Lifecycle
2. Fragments
3. Notifications
4. Screen Orientation
5. Implicit and Explicit Intents
6. Intents returning results
7. Working with Basic Widgets-Button, Textview, Edittext, Togglebutton, Radiobutton, Radiogroup, Autocompletetextview, Checkbox, Seekbar, Listview, Pickerviews.
8. Storing data permanently using Shared preferences, Files and SQLite
9. Sending SMS
10. Location Based Services
11. JSON Services
12. Socket Programming
13. Illustration of menus-Option menu, Context menu, Popup menu
14. Android Services
15. Android Threading

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THIRD SEMESTER

SOFT SKILLS-III: APTITUDE TRAINING II

Course Code	**: 2550310**	**Credits**	**: 02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 1.5**	**ESE Marks**	**: 50**

Module – I: Series – AP, GP, HP - Set Theory - Geometry - Trigonometry - Data interpretation – Data tables, pie charts, bar charts, line graphs, Venn Diagrams.

Module – II: Analogy - Series completion - Number Series - Letter Series - Coding & Decoding - Blood relations - Symbol based statement conclusion - Cubes and Dices - figure formation - mirror images - water images - paper cutting.

Module – III: Analytical Reasoning - Syllogism - Seating arrangements and cases - Ranking and Sequence test Deductive logic - Rule detection - Statement and assumptions - Statement and arguments - Statement and conclusions.

Reference Books:

1. R.S. Aggarwal, "**Quantitative Aptitude for Competitive Examinations**". S Chand Publishing, 20th Edition, 2013.
2. R.V. Praveen, "**Quantitative Aptitude and Reasoning**". PHI Learning, 2nd Edition, 2013.
3. **Abhijit** Guha, "**Quantitative Aptitude for Competitive Examinations**". McGraw Hill Education, 5th Edition, 2014.
4. Arun Sharma, "**How to Prepare for Quantitative Aptitude for the CAT**". McGraw Hill Education, 6th Edition, 2017.

E-References:

1. http://www.indiabix.com
2. http://www.geeksforgeeks.com
3. http://www.examveda.com
4. http://www.javatpoint.com
5. http://www.aptitudeschool.com

DEPARTMENT OF MCA

THIRD SEMESTER

SKILL ENCHANCEMENT COURSE-DISPCIPLINE SPECIFIC II: DEVOPS METHODOLOGIES

Course Code	**: 2529322**	**Credits**	**: 03**
L:T:P:S	**: 3:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 1.5**	**ESE Marks**	**: 50**

Learning Objectives:

- *To understand the concept DevOps*
- *To understand the tools like Git and Docker.*
- *To understand the implementation of tools in real time applications.*

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1	To introduce DevOps terminology, definition & concepts
CO2	To understand the different Version control tools like Git
CO3	To understand the concepts of Continuous Integration and Continuous Delivery Pipeline
CO4	To understand the life cycle of Docker
CO5	Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2	2	2	2	2	2	2
CO2	3	3	3	2	2	2	3	3	2	2
CO3	3	3	3	2	3	2	3	3	2	2
CO4	3	3	3	2	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3

3-Strong 2-Medium 1-Low

Module No.	**Contents of Module**	**Hrs**	**COs**
1	An Introduction - Why DevOps?- DevOps Architecture Features - Advantages and Disadvantages Of DevOps – DevOps life cycle – DevOps Architecture. What are DevOps engineers – roles and responsibility of DevOps engineer.	9	**CO1**
2	DevOps workflow – Principles – DevOps Tools – Puppet – Ansible- Docker – Nagios – CHEF – Jenkins – Git. DevOps Automation – Infrastructure automation – Configuration Management – Deployment Automation – Performance Management – Log Management – Monitoring.	**9**	**CO2**
3	DevOps Pipelines and Methodologies – Continuous Integration pipeline – Continuous Delivery pipeline – DevOps methodology	**9**	**CO3**
4	DevOps Tools – Introduction – features of Git – benefits of Git – GitHub – Git vs Github – Git version control system - Installing Git on Windows and Linux, Git commands, terminologies and tools.	**9**	**CO4**
5	Docker – What and Why of Containers – architecture of docker – software life cycle with docker.	**9**	**CO5**

Text Books:

1. Mikael Krief, "**Learning DevOps**", Second Edition, Packt Publishing,2022.
2. Craig Berg,"**DevOps for Beginners: A Complete Guide to DevOps Best Practices**",2020.
3. Adrian Mouat ,"**Using Docker**", First edition, O'Reilly Media, Inc,2015

Reference Books:

1. Bas Meijer, Lorin Hochstein, René Moser," Ansible**: Up and Running Automating Configuration Management and Deployment the Easy Way**", Third Edition, O'Reilly Media, Inc.,2022.
2. Jennifer Davis & Ryn Daniels, "**Effective DevOps building a culture of Collaboration affinity and tooling at scale**", First Edition, O'Reilly,2016.

E-References:

1. https://www.w3schools.com/git/
2. https://www.geeksforgeeks.org/devops-tutorial/
3. https://www.tpointtech.com/devops
4. https://www.tutorialspoint.com/devops/index.htm

********End of Third Semester********

DEPARTMENT OF MCA

FOURTH SEMESTER

CORE COURSE XI: PROJECT WORK AND VIVA VOCE

Course Code	**: 2529423**	**Credits**	**: 10**
L:T:P:S	**: 0:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 50**

Learning Objectives:
Students will be able to:

- *Implement the solution for the chosen problem using the concepts and the techniques learnt in the curriculum.*
- *Develop software applications*
- *Record the research results for a given problem*
- *Identify, formulate and implement computing solutions.*
- *Design and conduct experiments, analyze and interpret data.*
- *Analyze a system, component or process as per needs and specification.*
- *Work on multidisciplinary tasks and will be aware of the new and emerging disciplines.*
- *Demonstrate skills to use modern tools, software and equipments to analyze problems.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Demonstrate a sound technical knowledge, skills and attitude of their selected project topic.
CO2	Understand problem identification, formulation and solution.
CO3	Design solutions to complex problems utilizing a systems approach.
CO4	Communicate with engineers and the community at large in written and oral forms.

Mapping of COs to POs and PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	3	2
CO3	3	3	3	3	3	3	3	3	3	2
CO4	2	2	2	2	2	3	2	2	3	2
CO5	3	3	3	2	3	3	3	3	3	2

3-Strong 2-Medium 1-Low

DEPARTMENT OF MCA

FOURTH SEMESTER

SOFT SKILLS-IV: PERSONALITY EXCELLENCE

Course Code	**: 2550411**	**Credits**	**: 02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 1.5**	**ESE Marks**	**: 50**

Module-I: Personality Development

The concept of personality - Dimensions of personality – Theories of Freud & Erickson-Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analysis.

Module-II: Attitude and Motivation

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude-Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation-Factors leading to de-motivation

Module-III: Employability Quotient

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics –Good manners and etiquette. Resume building- The art of participating in Group Discussion – Facing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

Text Books:

1. Tony Blair, "**On Leadership: Lessons for the 21st Century**". Simon & Schuster, 2024.
2. Stephen P. Robbins, Timothy A. Judge. "**Organizational Behavior**". 16th Edition. Prentice Hall, 2014.
3. Hurlock, E.B. "**Personality Development**". 28th Reprint. New Delhi: Tata McGraw-Hill, 2006.
4. Pravesh Kumar. "**All About Self-Motivation**". New Delhi: Goodwill Publishing House, 2005.
5. Mile, D.J. "**Power of Positive Thinking**". Delhi: Rohan Book Company, 2004.
6. Hindle, Tim. "**Reducing Stress. Essential Manager Series**". DK Publishing, 2003.
7. Heller, Robert. "**Effective Leadership. Essential Manager Series**". DK Publishing, 2002.
8. Lucas, Stephen. "**Art of Public Speaking**". New Delhi: Tata McGraw-Hill, 2001.
9. Andrews, Sudhir. "**How to Succeed at Interviews**". 21st Reprint. New Delhi: Tata McGraw-Hill, 1988.

********End of Fourth Semester********

APPENDIX

OUTCOME-BASED EDUCATION (OBE)

Outcome-Based Education (OBE) is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation.

Program Educational Objectives (PEOs)

The Programme Educational Objectives of a program are the statements that describe the expected achievements of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after graduation.

Programme Outcomes (POs)

Program outcomes are finer statements that designate what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

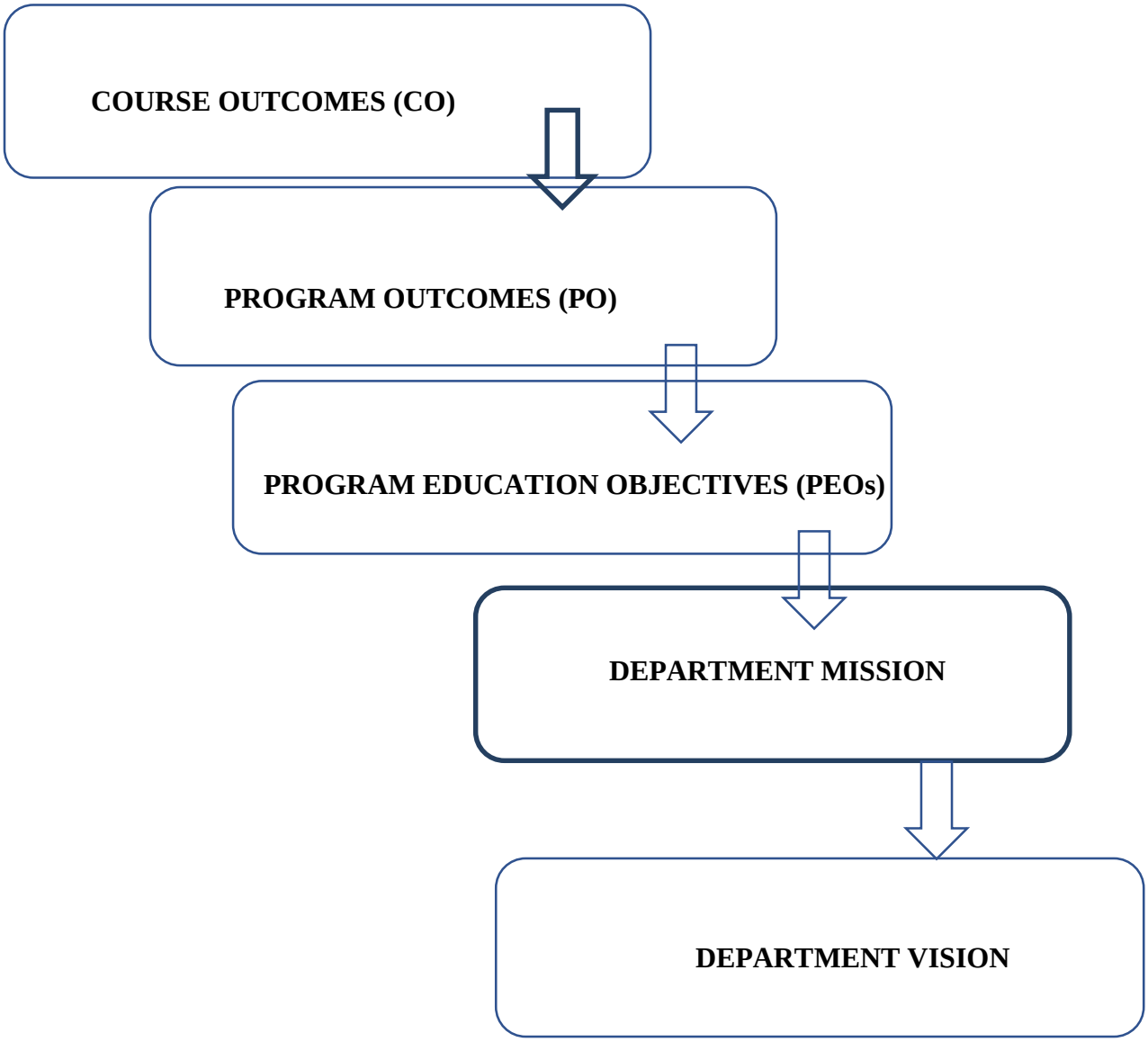
Programme Specific Outcomes (PSO)

Programme Specific Outcomes are what the students should be able to do at the time of graduation with reference to a specific discipline.

Course Outcome (CO)

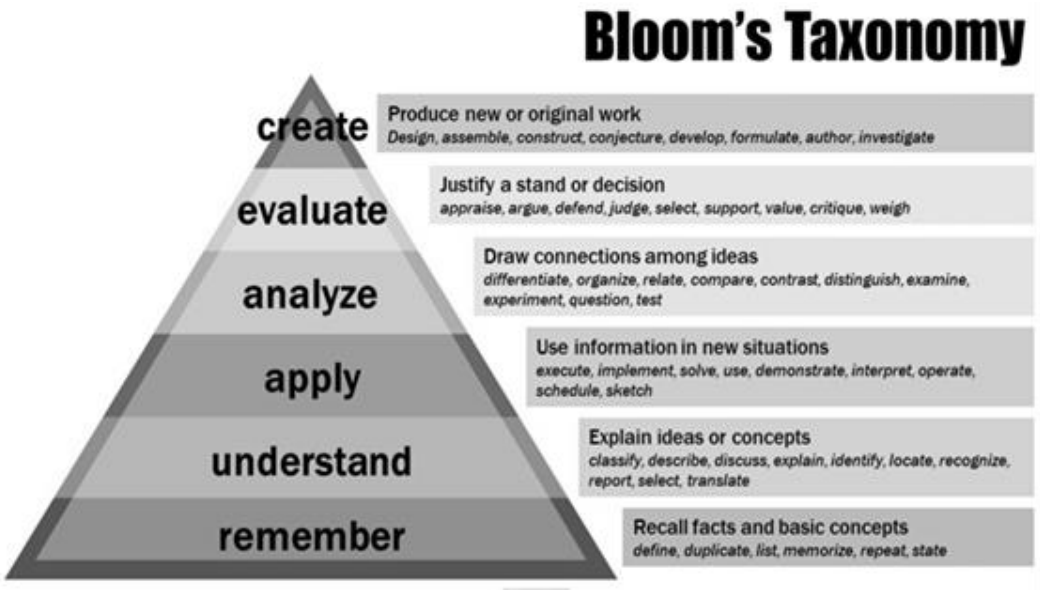
Course outcomes are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course.

MAPPING OF OUTCOMES



BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies. [eduglosarry.org]



Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

Level	Parameter	Description
K1	Knowledge	It is the ability to remember the previously learned material/information
K2	Comprehension	It is the ability to grasp the meaning of material
K3	Application	It is the ability to use learned material in new and concrete situations
K4	Analysis	It is the ability to break down material/concept into its component parts/subsections so that its organizational structure may be understood
K5	Synthesis	It is the ability to put parts/subsections together to form a new whole material/idea/concept/information
K6	Evaluation	It is the ability to judge the value of material/concept/statement/creative material /research report) for a given purpose