Department of Master of Computer Applications (MCA)

Syllabus

Academic Year 2024-25

Approved by AICTE and Recognized by Savitribai Phule Pune University, Pune

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INDEX

Sr. No.	Content	Page No.
1	Preamble	3
2	Vision and Mission	4
3	Outcome Based Education 3.1 Programme Outcomes (POs) 3.2 Programme Educational Objectives (PEOs)	5-6
4	Admission Details	7
5	Evaluation and Assessment	8-9
6	Prominent Features of the Syllabus	10-11
7	Highlights about Syllabus	12-13
8	Course Abbreviations	14
9	Course Code Abbreviations	15
10	Syllabus Structure	16-24

Preamble

MES' Institute of Management and Career Courses (IMCC) offers post graduate MCA programme affiliated Savitribai Phule Pune University (SPPU), approved by All India Council for Technical Education (AICTE) spans through two academic years with four semesters. The MCA curriculum implements Outcome Based Education along with Choice Based Credit System (CBCS). This MCA syllabus, aims at a comprehensive and rigorous education in computer application and technology, and provides a holistic approach. This programme is designed to foster a culture wherein students' talent is amplified with knowledge, skills, technical training and guidance needed to become competent professionals capable of tackling real-world problems in a variety of fields.

The curriculum has a total of 96 credits, spread over a period of two years. The curriculum is designed to expose students to both theoretical and practical aspects and provide them with hands- on experience in the latest technologies and tools used in the industry. In every semester, appearing for various certifications enables students to make their resume rich. In the first three semesters core courses, lab courses, mini project work, value added courses, MOOC courses, certifications, skill enhancement courses and courses under Indian Knowledge System (IKS) are offered to the students. In the fourth semester students are entitled to take up research publication and industry internship projects. In addition to the academic curriculum, students should also participate in various co-curricular and extra-curricular activities. These activities help students to develop their leadership, teamwork, and communication skills, and provide them with a well-rounded education.

Institute's Vision and Mission

Vision

IMCC's vision is to be a globally recognized institution ensuring excellence in academics, innovation, research and entrepreneurship. Institute envisions producing, highly knowledgeable, ethically strong, self -motivated professionals who will contribute effectively towards society and nation.

Mission

- To make the Institute a front-runner in the fields of Academics and Research.
- To create a center of excellence to develop multi-faceted professionals who will meet global needs.
- To provide a holistic learning environment for versatile development of learners.
- To encourage flair for entrepreneurship among learners.
- To groom students into ethically sound, socially responsible and nationally committed professionals.

Programme Outcomes (POs)

At the end of the MCA programme the learner will possess the following Program Outcome:

PO1: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

PO2: Identify, formulate, research literature, and solve complex Computing problems reaching substantiated conclusions using fundamental principles of Mathematics, Computing sciences, and relevant domain disciplines.

PO3: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

PO5: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

PO6: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

PO7: Recognize the need, and have the ability, to engage in independent learning for continual development as a Computing professional.

PO8: Demonstrate knowledge and understanding of computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO9: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective

reports, design documentation, make effective presentations, and give and understand clear instructions.

PO10: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

PO11: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

PO12: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Programme Educational Objectives (PEOs)

1. To prepare students to excel in computer applications to succeed in the Industry/Technical profession.
2. To provide students with a solid foundation in mathematical and computing fundamentals to comprehend, analyze, design and create computing solutions for real life problems.
3. To inculcate in students professional and ethical attitude, effective communication skills, multidisciplinary approach and an ability to relate computing issues to broader social context.
4. To provide students with an academic environment, which imbibes leadership and continuous learning on technology and trends needed for a life-long career in related areas.

Admission Details

Eligibility for Admission: The eligibility criteria for admission for the MCA course will be as decided by the All Indian Council of Technical Education (AICTE), New Delhi and Directorate of Technical Education (DTE), Government of Maharashtra. It will be published on their respective websites from time to time.

Reservation of Seat: The percentage of seat reserved for candidates belonging to backward classes only from Maharashtra State in all the Government Aided, Un-aided Institutions/Colleges and University Departments is as per the norms given by Government of Maharashtra, time to time.

Selection Basis: The selection would be done as per the guidelines given by the Director of Technical Education, Maharashtra State, from time to time.
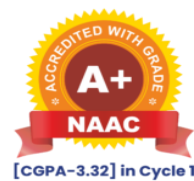
Evaluation and Assessment

Concurrent Evaluation: A continuous assessment system in the semester system is spread through the duration of course and is done by the teacher teaching the course. The continuous assessment provides feedback on the teaching learning process. As a part of concurrent evaluation, the learners shall be evaluated on a continuous basis by the institute to ensure that student learning takes place in a graded manner. Concurrent evaluation components should be designed in such a way that the faculty can monitor the student learning & development and intervene wherever required. The faculty must share the outcome of each concurrent evaluation component with the students, soon after the evaluation, and guide the students for betterment. Individual faculty members shall have the flexibility to design the concurrent evaluation components in a manner so as to give a balanced assessment of student capabilities across Knowledge, Skills & Attitude (KSA) dimensions based on a variety of assessment tools. The institute can decide the type, method and frequency of concurrent evaluation for each course and execute accordingly. Detailed record of the concurrent evaluation shall be maintained by the institute. The curriculum has a total of 102 credits, spread over a period of two years, four semesters as follows.

Semester	Credits	Marks
Semester I	26	650
Semester II	26	650
Semester III	26	650
Semester IV	18	450
TOTAL	**96**	**2400**
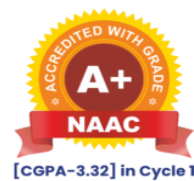
Rules of ATKT (Allowed To Keep Term):

A student can register for the third semester, if he/she earns a minimum 50% credits of the total of first and second semesters.

Maximum Duration for completion of the Programme:

The candidates shall complete the MCA Programme **WITHIN 5 YEARS** from the date of admission, by earning the requisite credits. The student will be finally declared as failed if she/he does not pass in all credits within a total period of four years. After that, such students will have to seek fresh admission as per the admission rules prevailing at that time.

Marks/Grade/Grade Point:

A grade is assigned to each head based on marks obtained by a student in evaluation of the course. These grades, their equivalent grade points are given in the following table.

Marks	Grade	Grade Points
80-100	O: Outstanding	10
70-79	A+: Excellent	9
60-69	A: Very Good	8
55-59	B+: Good	7
50-54	B: Above Average	6
45-49	C: Average	5
40-44	P: Pass	4
0-39	F: Fail	0
-	AB: Absent	0

Prominent Features of the Syllabus

- Outcome Based Education (OBE)
- Experiential, Practical, Project Based Learning
- Entreprenuership Development
- Placement Readiness through Trainings
- Personality Development Courses
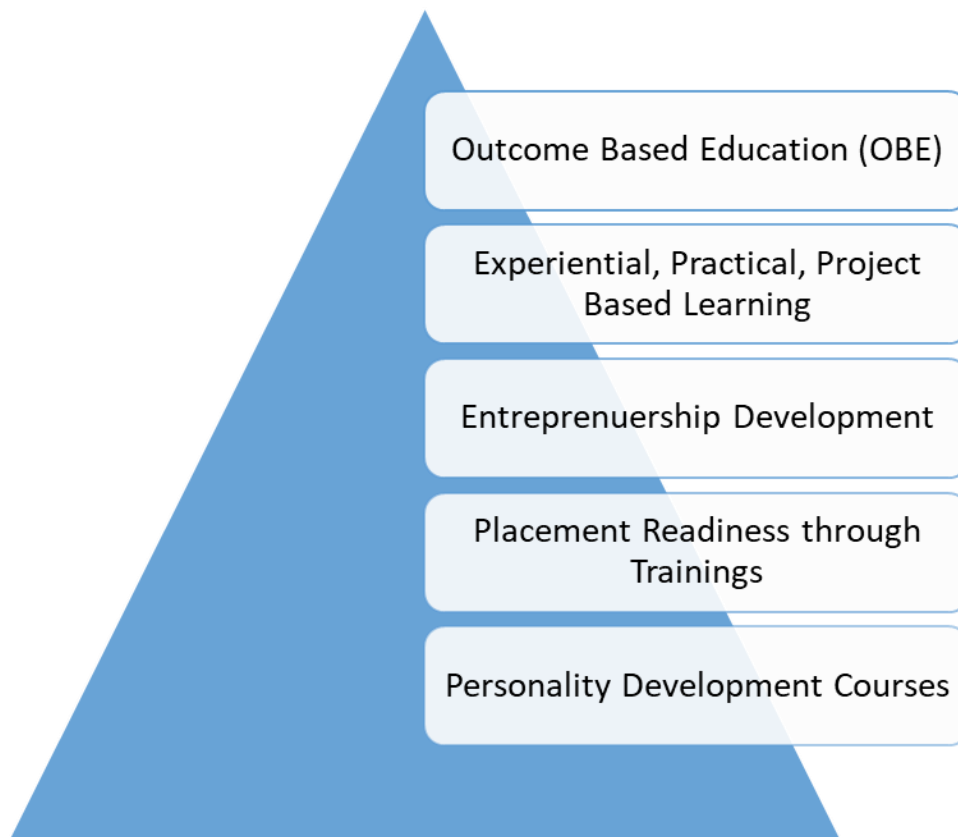
Contributors to the syllabus designing process:
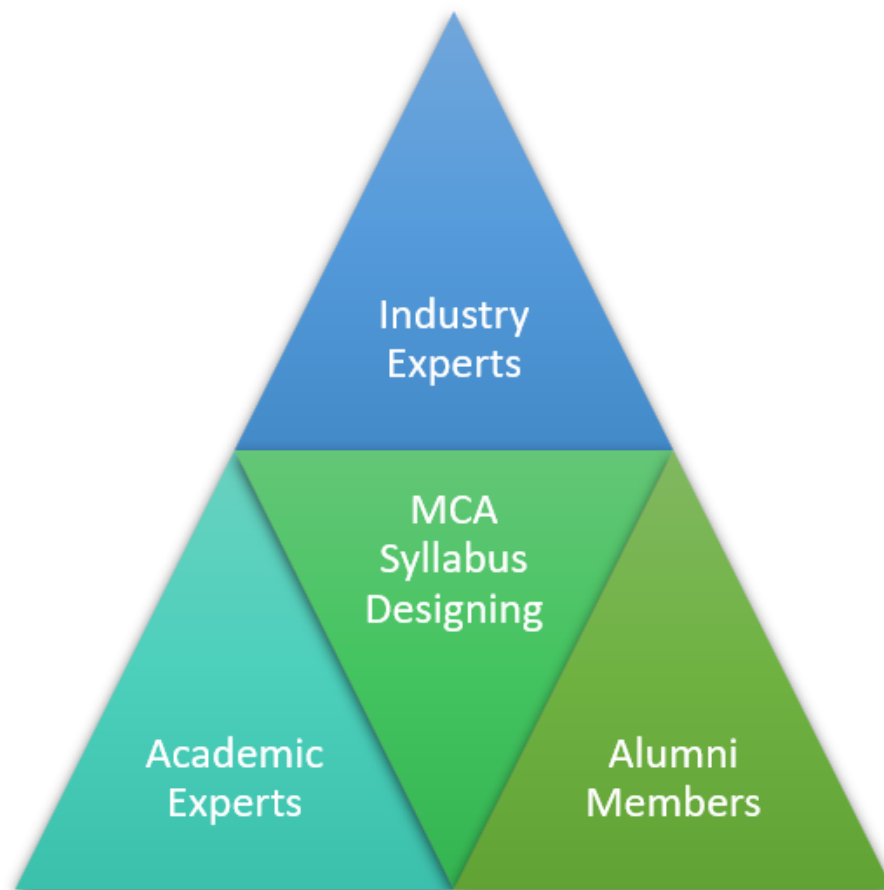
Syllabus Highlights

- **Bridge Course:** The Bridge Course aims to ensure that all students, regardless of their prior background, have the necessary knowledge and skills to excel in their studies. This course is particularly beneficial for students transitioning from different academic streams or those who need a refresher on fundamental concepts.

- **Foundational Core Courses**: These core courses are designed to provide students with the essential knowledge and skills needed to excel in the field of computer applications. For Example: Data Science and Machine Learning, Full stack development, Cyber Security etc.

- **Value Added Courses:** Value Added Courses are designed to provide students with additional skills and knowledge that will enhance their academic and professional journey. These courses will give students a competitive edge in the job market and prepare them for future challenges.

- **Certifications Courses and MOOC Courses:** Certification Courses are designed to provide students with specialized skills and industry-recognized credentials that will enhance their career prospects and professional growth. Institute provides platforms of high-quality MOOC courses to students of their choice and subject interests.

- **Multidisciplinary Courses:** Institute aims to develop intellectual, aesthetic, social, physical, emotional, and moral capacities of students by giving a holistic and multidisciplinary education. Students can earn the credit by completing personal development hobby courses of their choice.

- **Indian Knowledge System (IKS):** Indian Knowledge Systems (IKS) is incorporated in an accurate and scientific manner throughout the curriculum and

focuses on the holistic development of students, nurturing their physical, mental, and spiritual well-being.

● **Project Development Life Cycle and Framework:** Project Development Life Cycle (PDLC), a critical framework that guides the systematic development and management of software projects with the extensive use of tools.

Course Abbreviations

Abbreviation	Course Full Name
PCC	Professional Core Course
VAC	Value Added Course
PEC	Professional Elective Course
PR	Practical
PROJ	Project work / Internship in industry
SEC	Skill Enhancement Course
IKS	Indian Knowledge System
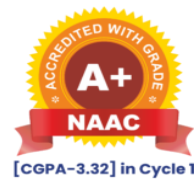
Course Code Abbreviations

Abbreviation	Course Full Name
IT	Information Technology
EC	Elective Course
ITL	Information Technology-Lab
ITP	Information Technology-Project
SS	Soft Skill
IKS	Indian Knowledge System

Syllabus Structure

Semester I				
Course Code	**Course Type**	**Course Name**	**Credits**	**Marks**
IT11	PCC	Python Programming	3	75
IT12	PCC	Data Structure and Algorithms	3	75
IT13	PCC	Advanced DBMS	3	75
IT14	PCC	Network Technologies and Infrastructure Management	3	75
IT15	PCC	Organizational Behavior	3	75
EC11	VAC	Value added course	2	50
EC12	PEC	Multidisciplinary Course/MOOC-I	1	25
ITL11	PR	Practical based on Python Programming, Data Structure and Algorithms and Advanced DBMS	3	75
ITP11	PROJ	Mini Project	3	75
SS11	SEC	Soft Skills - I	1	25

IKS11	IKS	Indian Knowledge System	1	25
Total			**26**	**650**

Semester I	

Value Added Courses (EC11)		Multidisciplinary Courses (EC12)	
VAC	Programming Logic and Techniques	PEC	Digital Marketing- SEO
VAC	Django framework	PEC	Linux Shell Programming
VAC	Distributed Computing	PEC	Data Visualization (Power BI, Tableau)
VAC	Flask Framework	PEC	Web Technology (HTML, CSS, JavaScript)
VAC	Advanced Operating System	PEC	Data Warehousing (ETL, OLAP)
		PEC	Enterprise Resource Planning (ERP)
		PEC	Foundation of Stock Market Investing
		PEC	Accountancy and Financial Management

Course Code	Course Type	Course Name	Credits	Marks
	PEC	Multidisciplinary Course for holistic development.		

Semester II				
Course Code	**Course Type**	**Course Name**	**Credits**	**Marks**
IT21	PCC	Java Programming	3	75
IT22	PCC	Full Stack Development	3	75
IT23	PCC	Cyber Security	3	75
IT24	PCC	Software Project Management	3	75
IT25	PCC	Research Methodology	3	75
EC21	VAC	Value added course	2	50
EC22	PEC	Multidisciplinary Course/MOOC- II	1	25
ITL21	PR	Practical based on Java Programming, Full Stack Development and Cyber Security	3	75
ITP21	PROJ	Mini Project (Research Project)	3	75
SS21	SEC	Soft Skills - II	1	25

IKS21	IKS	Indian Knowledge System	1	25
Total			**26**	**650**

Semester II			
Value Added Courses (EC21)		**Multidisciplinary Courses (EC22)**	
VAC	UI/UX Design	PEC	Green Computing
VAC	Bootstrap	PEC	Computer Graphics and Multimedia
VAC	Object Oriented Design	PEC	CRM
VAC	Database Administration	PEC	ECommerce
VAC	Ethical Hacking	PEC	Cyber Forensics
		PEC	Big Data Frameworks and Technologies
		PEC	Investment and Trading Strategies
		PEC	Edge Computing

		PEC	Multidisciplinary Course for holistic development

Semester III					
Course Code	**Course Type**	**Course Name**		**Credits**	**Marks**
IT31	PCC	Mobile Application Development		3	75
IT32	PCC	Data Science and Machine Learning		3	75
IT33	PCC	Software Testing and Quality Assurance		3	75
IT34	PCC	Innovation and Entrepreneurship Development		3	75
IT35	PCC	Principles of Cloud Management and Security		3	75
EC31	VAC	Value added course		2	50
EC32	PEC	Multidisciplinary Course/MOOC- III		1	25
ITL31	PR	Practical based on Mobile Application Development, Machine Learning and Software Testing		3	75
ITP31	PROJ	Mini Project (Research Project)		3	75
SS31	SEC	Soft Skills - III		1	25

IKS31	IKS	Indian Knowledge System	1	25
Total			**26**	**650**

Semester III			
Value Added Courses (EC31)		**Multidisciplinary Courses (EC32)**	
VAC	Blockchain	PEC	IOT
VAC	Devops (Maven, Docker)	PEC	Generative AI
VAC	Automation Testing Tool	PEC	Network Administration
VAC	Deep Learning	PEC	NLP
VAC	Salesforce	PEC	Computer Vision (Image processing, classification and object detection)
		PEC	Introduction to Quantum Computing
		PEC	Progressive Web Applications
		PEC	R programming
		PEC	Multidisciplinary Course for holistic development

Semester IV				
Course Code	**Course Type**	**Course Name**	**Credits**	**Marks**
EC41	PCC	MOOC-IV	3	75
EC42	PCC	MOOC-V	3	75
ITP41	PROJ	Internship / Project	12	300
Total			**18**	**450**
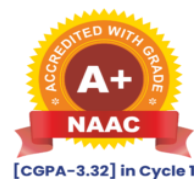
Semester IV				
MOOC- IV (EC41)		**MOOC- V (EC42)**		
1	Android Mobile Application Development	1	Scilab	
2	Android app using Kotlin	2	Ruby	
3	Arduino	3	Advanced Algorithmic Trading and Portfolio Management	
4	Artificial Intelligence for Economics	4	Advanced Corporate Strategy	
5	Business Organisation and Management	5	Income Tax Law and Practice	
6	E-Commerce	6	LaTeX & XFig - typesetting software	
7	Introduction to Intellectual Property	7	Metaverse Spark AR	
8	Advanced Business Decision Support Systems	8	Big Data Computing	

Total Credits		
Semester	**Credits**	**Marks**
Semester I	26	650
Semester II	26	650
Semester III	26	650
Semester IV	18	450
TOTAL	**96**	**2400**

SEMESTER I

Program: MCA (First Year)	**Semester: I**
Course Name: Python Programming	**Course Code: IT11**
Course Type: Professional Core Course (PCC)	**Credit Points: 3**

Course Objectives:

    1. To understand why Python is a useful scripting language for developers.

    2. To understand advanced concepts of python and be able to apply it for solving the problems.

    3. To understand the reading and writing data through file handling.

    4. To understand basic database concepts in python.

    5. To develop the critical thinking and analytical approach by using python libraries.

Course Outcomes with Blooms Level

Student will be able to

CO1: Demonstrate the use of Object types, functions, modules and Regular Expressions in Python programming and Regular Expression

CO2: Use python libraries to create applications

CO3: Apply the concepts of Object Oriented Programming and file operations

CO4: Implement Exception Handling and Multithreading

CO5: Execute CRUD operations on MySQL / MongoDB database

Mapping of Course Outcomes to Program Outcomes

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

Maharashtra Education Society's

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[CGPA-3.32] in Cycle 1

Prerequisites

Basic programming constructs like conditional statements, looping, functions, concepts of file handling and database.

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required
1	**Introduction** 1.1 Data Types and Operators 1.2 Python Object Types-Number, Strings, Lists, Dictionaries, Tuples , List Comprehension 1.3 Python blocks, Program Flow Control, Conditional blocks using if, else and elif, For loop, while loops using pass, continue, break and else 1.4 File Operation: Read functions: read(), readline() and readlines(); Write functions: write() and writelines(); Manipulating file pointer using seek	20	10
2	**Object Oriented Programming** 2.1 Concept of class, object, method call, Accessing class members outside the class 2.2 Setter and Getter Methods 2.3 Constructor and destructors 2.4 Inheritance, super class and overloading operators 2.5 Static and class methods 2.6 Delegation and container	15	7
3	**Python Functions, Modules & Packages** 3.1 Function Basics-Scope, nested function, non-local statements, built-in functions, Arguments Passing, Anonymous Function: lambda 3.2 Decorators and Generators 3.3 Module basic usage, namespaces, reloading	15	7

	modules. – math, random, datetime, map, filter, reduce 3.4 Package: import basics, namespace packages and user defined modules and packages, asyncio, Introduction to FastAPI		
4	**Introduction to Python Libraries** 4.1 NumPy: Arrays, Scalars, Universal Array functions 4.2 Pandas: Series and DataFrames, Missing Data, Drop Entry, Selecting Entries, Data Alignment, Rank and Sort 4.3 Matplotlib: Data Visualization Tools-line plot, bar chart, pie chart, scatter plot and histogram	**15**	**6**
5	**Regular Expressions** 5.1 Metacharacters and their usage 5.2 Common Patterns and Techniques 5.3 Lookahead and Lookbehind Techniques 5.4 Building Regex Patterns 5.5 Pattern matching and Searching 5.6 Examples and Use Cases in Regular Expressions: Validating email, password, url, cleaning text data, extracting dates and times, parsing csv files etc.	**10**	**4**
6	**Exception Handling, Multithreading** 6.1. Exception Handling: try, except, finally, raise 6.2. Multithreading 6.3. Synchronizing the threads: sleep(), join()	**10**	**4**
7	**Using Databases in python** 7.1 Introduction to SQL and NoSQL databases 7.2 Setting up MySQL and MongoDB with Python (pymongo) 7.3 Working with Databases and Collections 7.4 CRUD operations 7.5 Working with aggregation API	**15**	**7**
	Total:	**100**	**45**

Course References:

I. Reference Books

1. [Python: The Complete Reference by Martin C. Brown](#)
2. [Python Data Analytics: With Pandas, NumPy, and Matplotlib 2nd ed. Edition by Fabio Nelli](#)
3. [Introduction to Python Programming, By Gowrishankar S, CRC Press](#)

II. Websites

1. https://www.python.org/about/gettingstarted/
2. https://www.w3schools.com/python/python_intro.asp
3. https://realpython.com/async-io-python/
4. https://www.tutorialspoint.com/fastapi/fastapi_introduction.htm
5. https://www.geeksforgeeks.org/python-sqlite/

III. Other (Certification course/MOOC etc)

1. https://www.coursera.org/courses?query=python
2. https://cs50.harvard.edu/python/2022/

Program: MCA (First Year)	Semester: I
Course Name: Data Structure and Algorithms	Course Code: IT12
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:

1. To learn the representation of data structure and operations performed on it.
2. To understand implementation of data structures.
3. To solve problems using various programming techniques such as greedy, divide-conquer and dynamic programming,

Course Outcomes with Blooms Level

Student will be able to

CO1: Demonstrate linear data structures linked list, stack and queue

CO2: Implement different types of tree data structure

CO3: Use graph data structure to visualize and simplify problems

CO4: Solve problems using greedy and divide-conquer approaches
CO5: Implement dynamic programming technique to solve different problems

Mapping of Course Outcomes to Program Outcomes

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

Prerequisites

Loops, Functions, Pointers, Arrays, Memory Allocation, Recursion,

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required
1	**Linear Data Structures** 1.1 Linked List: Singly Linked List, Doubly Linked List, Circular Linked List 1.2 Stack: Implementation of stack using linked list, applications 1.3 Queue: Implementation of queue using linked list, circular queue, priority queue, De-queue, applications	20	10
2	**Tree** 2.1 Tree 2.2 Binary Search Tree 2.3 AVL Tree	20	8

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	2.4 Red-Black Tree 2.5 Segment Tree - with min/max/sum range Queries		
3	**Graph** 3.1 Directed and Undirected Graph 3.2 Graph Representations- Adjacency Matrix, Adjacency List 3.3 Graph Traversals- BFS, DFS	10	5
4	**Greedy** 4.1 Jump Game 4.2 Fractional Knapsack Problem 4.3 Dijkstra Algorithm 4.4 Prim's Algorithm 4.5 Kruskal's Algorithm	15	7
5	**Divide and Conquer** 5.1 Binary Search 5.2 Tower of Hanoi 5.3 Pascal's Triangle 5.4 Euclidean Algorithm 5.5 Merge Sort 5.6 Quicksort	20	8
6	**Dynamic Programming** 6.1 Unique Paths 6.2 Longest Common Subsequence (LCS) 6.3 Longest Increasing Subsequence 6.4 0/1 Knapsack Problem 6.5 Integer Partition	15	7
	TOTAL	100	45

Course References:

I.   Text/Reference Books

1. Jean Paul Tremblay, Paul G. Sorensons, "AN Introduction to Data Structures with Application", McGraw Hall Publication (INDIAN edition)
2. A. V. Aho and J.D. Ullman, "Design and Analysis of Algorithms", Addison Wesley
3. Thomas H Cormen and Charles E.Leiserson, "Introduction to Algorithm" PHI
4. Horowitz/Sahani, Fundamental of Algorithm. PHI, Galgotia
5. Practical Approach to Data Structures by Hanumanthappa

II.   Websites

1. https://www.w3schools.com/dsa/dsa_intro.php
2. https://techdevguide.withgoogle.com/paths/data-structures-and-algorithms/
3. https://www.tutorialspoint.com/data_structures_algorithms/index.htm

III.   Other (Certification course/MOOC etc)

1. https://www.coursera.org/specializations/data-structures-algorithms
4. https://nptel.ac.in/courses/106102064

Program: MCA (First Year)	Semester: I
Course Name: Advanced DBMS	Course Code: IT13
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:

1. To understand the basic concepts and terminology related to DBMS and the Relational Database Design approach using normalization
2. To gain an awareness of the structure of Parallel databases, Distributed Databases and Object-relational database
3. To become familiar with the basic issues of transaction processing and concurrency control
4. To Demonstrate SQL and NO SQL database

Course Outcomes with Blooms Level

Students will be able to

CO1: Design relational database using E-R model and normalization

CO2: Create a Database and write Comprehensive SQL Queries

CO3: Manipulate data using MongoDB commands

CO4: Apply the Graph Database and Analytics techniques to solve the queries

CO5: Understand the basic concepts of time series database

Mapping of Course Outcomes to Program Outcomes

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

Prerequisites

DBMS architecture, Relational Algebra, Stored procedures

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required
1	**Introduction to Relational Databases Language** 1.1 Databases and Data Modelling Database Background, Relational Databases, Conceptual and Physical Data Models, Entities, Attributes and Relationships 1.2 Entity-Relationship Modeling (ERDs) 1.3 Data Model Design/Fundamentals Normalization (up to 3 NF) and Business Rules, Data Modeling Terminology and Mapping Solving Case Study-based problems. 1.4 ACID Properties	20	10

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[CGPA-3.32] in Cycle 1

2	**Structured Query Language**
	2.1 Database Programming with SQL
	      Data Definition Language (DDL)
	      Datatypes, Table, View, Sequence & Synonyms
	2.2 Data Manipulation Language (DML)
	        Insert/Update/Delete/Merge
	 2.3 Transaction Control Language (TCL)
	        Commit/Rollback/Savepoint
	 2.4 Structured Query Language (SQL)
	        Retrieving Data Using SELECT
	        Restricting Data Using WHERE
	        Sorting Data Using ORDER BY
	        Joining Tables Using JOIN
	 2.5 Constraints
	      NOT NULL and UNIQUE Constraints,
	      Primary Key, Foreign Key & CHECK Constraints
	 2.6 Indexes
	 2.7 Single-row functions
	      CASE, Number, Date, Conversion, NULL
	 2.8 Group Functions
	        COUNT, MIN, MAX, SUM
		30	13

3	**Introduction to NoSQL Database** 3.1 NoSQL database concepts: Types of NoSQL databases, NoSQL data modeling, Benefits of NoSQL, Comparison between SQL and NoSQL database system. 3.2 NoSQL using MongoDB: Introduction to MongoDB shell, Running the MongoDB shell, MongoDB client 3.3 Querying with MongoDB: Basic CRUD operations with MongoDB shell, Basic data types, Arrays, Embedded Documents	20	10
4	**Graph Database and Analytics** 4.1 What is a Graph Database? 4.2 Why Graph Databases? 4.3 Property Graphs and RDF Graphs 4.4 Creating Graphs 4.5 Querying Graphs 4.6 Analyzing Graphs	15	6

5	**Time series Database** 5.1 What is a Time series database? 5.2 The importance of time series database 5.3 Examples of Time series data 5.4 Examples of Time series database - Influxdata, Prometheus	15	6
	Total	**100**	**45**

Course References:

I. **Reference Books**

1. Ramez Elmasri, Shamkant B.Navathe, "*Fundamentals of Database Systems*", Pearson Education, 5th Edition, 2007
2. Database Management system A Practical approach, Dr. Rajiv Chopra, S.Chand
3. Introduction to database system C.J. Date, Pearson.
4. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", Tata McGraw Hill, Sixth Edition
5. Thomas M Connolly and Carolyn E Begg, "*Database systems- A Practical Approach to Design, Implementation and Management*", Pearson Education, 4th Edition (2014).
6. Kristina Chodorow, MongoDB, "The Definitive Guide", O'Reilly, 2nd Edition, 2013

II. **Websites**

1. https://www.mysqltutorial.org/
2. https://www.tutorialspoint.com/mongodb/index.htm
3. https://www.javatpoint.com/nosql-databases
4. https://academy.oracle.com/en/solutions-curriculum-database.html#db1-tab
5. https://db-engines.com/en/ranking
6. https://learn.mongodb.com/
7. https://db-engines.com/en/article/Time+Series+DBMS
8. https://www.influxdata.com/time-series-database/
9. https://www.influxdata.com/time-series-database/#why-important
10. https://www.influxdata.com/what-is-time-series-data/
11. https://prometheus.io/docs/introduction/overview/
12. https://www.oracle.com/in/database/graph/
13. https://neo4j.com/product/neo4j-graph-database/

III. **Other (Certification course/MOOC etc)**

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1. Oracle certified associate (OCA)
2. Oracle certified professional (OCP)
3. Database administrator (DBA)
4. MongoDB Professional Certification
5. MongoDB Database administrator
6. Database-related certification courses are available at NPTEL/Coursera/Udemy
7. https://academy.oracle.com/en/membership-benefits.html

Program: MCA (First Year)	Semester: I
Course Name: Network Technologies and Infrastructure Management	Course Code: IT14
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:
1. To study various components of Network designing
2. To study the network fundamentals
3. To study the modeling technologies and Design principles
4. To study the Physical Infrastructure for small house or workplace
5. To Analyze the network and troubleshooting

Course Outcomes with Blooms Level

Student will be able to

CO1: Explain the knowledge of various network devices

CO2: Use basic knowledge of network devices and configuration

CO3: Identify network technologies and Design small networks

CO4: Implement Physical Infrastructure for small networks

CO5: Examine designed networks for troubleshooting

Mapping of Course Outcomes to Program Outcomes

Prerequisites:

No specific Requirement

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required
1	**Networking Basics I** 1.1. Network Types, Data Transmission, Bandwidth and Throughput 1.2. Network Components, Types and Connections 1.3. Wireless and Mobile Networks 1.4. Communication Principles – Protocols, Standards and Models 1.5. Network Media Types 1.6. The Access Layer – Encapsulation and Ethernet Frame	20	9
2	**Networking Basics II** 2.1. Internet Protocol (IPv4 & IPv6) – Addressing and Formats 2.2. DHCPv4 configuration 2.3. Network Boundaries – NAT 2.4. The ARP Process 2.5. Routing Between Networks 2.6. TCP and UDP 2.7. Application Layer Services – DNS, FTP, Email 2.8. Network Testing Utilities	25	12
3	**Networking Devices** 3.1. Network Design 3.2. Cloud and Virtualization 3.3. Number System 3.4. Ethernet Switching	20	9

4	**Initial Configuration** 4.1. Network Layer – IPv4 & IPv6 packets 4.2. Address Resolution 4.3. IP Addressing Services – DNS & DHCP 4.4. TCP Communication Process 4.5. ICMP	**15**	**7**
5	**Network Addressing and Basic Troubleshooting** 5.1. Physical Layer Cabling 5.2. Topologies & Media Access Control 5.3. Routing Tables 5.4. GUA and LLA configuration 5.5. Neighbour Discovery 5.6. Switches and Routers 5.7. Troubleshooting Process	**20**	**8**
	Total	**100**	**45**

Extra Reading for Self Learning:

Network Documentation, Help Desks, Troubleshooting End-point/Network Connectivity, Defending System and Devices, CCST Exam

Course References:

I.   Reference Books
1. TCP/IP Network Administration, Craig Hunt, O'Relly Publication.
2. Internetworking with TCP-IP: Design, Implementation, and Internals, by D. E. Comer and D. L. Stevens Vol II, Prentice Hall.
3. Behrouz A. Forouzan, "TCP/IP Protocol Suite", III Edition, Tata McGraw Hill, 2005.
4. Specifications of The Art of the Data Center: A Look Inside the World's Most Innovative and Compelling Computing Environments By Douglas Alger, Pearson 2012

II.   Websites
1. **https://www.networkacademy.io**
2. **https://networklessons.com/**
3. **https://www.netacad.com/**

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III.   Other (Certification course/MOOC etc)
      i. CISCO - https://www.cisco.com/c/en/us/training-events/training-certifications/certifications.html
      ii. RHCE - https://www.redhat.com/en/services/certification/rhcsa-rhos
      iii. Oracle - https://education.oracle.com/learn/oracle-cloud-infrastructure/pPillar_640

Program: MCA (First Year)	Semester: I
Course Name: Organizational Behavior (OB)	Course Code: IT15
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:
1. To understand the processes of organizational growth and development
2. To grasp the role of an individual and group behavior therein for motivation of employees
3. To provide a deeper knowledge of organizational behavior with specific emphasis on Indian situations.
4. To gather the behavior of individuals and groups inside organizations for management prosperity.
5. To organize and enhance skills in understanding and appreciating individuals, interpersonal, and group process for increased effectiveness both within and outside of organizations

Course Outcomes with Blooms Level

Student will be able to
CO1: Describe the key concepts of organizational behavior and politics.
CO2: Discuss theories about how managers should behave to motivate and control employees.
CO3: Identify aspects of organizational culture and interpret cultural diversity.
CO4: Build social and leadership skills essential for managerial success.
CO5: Analyze causes of conflict and conflict management strategies that managers can use to resolve organizational conflict effectively.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1		2										
CO2		3	2					2				
CO3											3	
CO4		1									3	
CO5		1	3									

Prerequisites *: No specific Requirement*

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required
1	**1.1 Fundamentals of OB** Definition and importance of OB, Disciplines that contributes to the field of OB, Challenges and Opportunities for OB **1.2 Personality & Values** Definition of Personality, The Myers-Briggs Type Indicator and The Big Five personality model, Johari Window, Transaction Analysis . Values - The importance of values, Terminal Versus Instrumental Values, Generational Values, Linking an individual's personality and values to the workplace (Person-Job Fit & Person -Organization Fit) **1.3 Business Ethics and Moral** Definition, Nature, Golden rule of ethics, Principles of Ethics, Need and importance of Ethics in Organization Culture. Understanding Business Ethics, Levels of Business Ethics:Personal Ethics, Professional Ethics, Organizational Ethics. Business Moral Vs. Business Ethics, Business Moral and its importance. Factors of Business Moral in Organization.	20	10

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2	**2.1 Perception** Meaning of perception (Factors influencing Perception), Person Perception : Making Judgements about others - Attribution theory, Common shortcuts in judging others - Selective perception, Contrast Effect, Specific Applications of Shortcuts in Organizations **2.2 Motivation** Definition of Motivation, Early Theories of Motivation - Hierarchy of Needs, Theory X and Theory Y, Two - Factor Theory. Contemporary Theories of Motivation - Self Determination Theory, Expectancy Theory, Equity Theory	20	10
3	**3.1 Foundation of Group Behaviour** Defining & Classifying Groups, The Five-Stage Model of Group Development , Group Decision Making **3.2 Leadership** What is leadership? , Theories of Leadership - Trait Theory (The Great Man Theory), Behavioral Theory, Contingency Theory, Leader - Member Exchange Theory (LMX)	20	8
4	**4.1 Conflict Management** Definition and three pillars of conflict management, Conflict Management Approaches (Competing, Collaborating, Avoiding, Accommodating, Compromising) **4.2 Organizational Culture** Meaning of Organization Culture, What do cultures do?, Creating and sustaining Culture, How employees learn Culture, Cultural Diversity	20	8
5	**5.1 Power & Politics** A definition of power, Contrasting leadership and power, Bases of power, Politics : Power in Action - Definition of Organizational Politics, The reality of politics, Causes and consequences of political behavior **5.2 Organizational Change**	20	9

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	Meaning of Organizational Change, Forces that act as stimulants to change, Sources of Resistance to Change, Overcoming Resistance to Change, Kurt Lewis's- Three-step model, Nudge Theory of Change Management		
	Total	**100**	**45**

Extra Reading for Self Learning:

Management and its types, 14 Principles of Management, Managerial Hierarchy and Managerial Functions, Decision Making, Individual Vs Group decision making, Herbert Simon's Model & Principle of Rationality, Leadership Styles, Team Building, Stress Management and Personality Development traits.

Course References:

I. Reference Books

1. Organizational Behaviour, Stephen Robins, Timothy Judge, Neharika Vohra
2. Organizational Behaviour, Robins
3. Organizational Behaviour, Nelson & Quick
4. Organizational Behaviour, Fred Luthans
5. Organizational Behaviour, M N Mishra
6. Organizational Behaviour, K Ashwathappa
7. Understanding OB, Uday Pareek
8. Change & Knowledge Management, Janakiram, Ravindra and ShubhaMurlidhar
9. Human Resource Management, Nkomo, CENGAGE Learning

II. List of Activities:

1. Activity based on Motivation
2. Activity Based on Leadership Skills
3. Activity for effective Group Dynamics
4. Activity for Team Building
5. Activity Based on Emotional Intelligence

Program: MCA (First Year)	Semester: I

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Course Name: Practical based on Python Programming, Data Structure and Algorithms and Advanced DBMS	Course Code: ITL11
Course Type: Practical (PR)	Credit Points: 3

Course Objectives:
1. To build efficient programming skills in students.
2. To impart the basic concepts of data structure and algorithms
3. To learn concepts of python programming
4. To provide a strong foundation in database concepts, techniques and practice to the students

Course Outcomes with Blooms Level

Student will be able to

CO1: Demonstrate data structures and various algorithmic approaches (apply)

CO2: Solve problems using python programming (apply)

CO3: Design database and Demonstrate SQL (apply)

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2		2		2					
CO2	3	3	2		2		2					
CO3	3	3	2		2		2					

Prerequisites

Basic programming constructs- arrays, if-else, loops, pointers, memory allocation etc, basic concepts of storage, DBMS architecture

Course Structure

Sr. No.	List of Practicals
1	**Python Programming** 1.1 Assignments based on conditional and looping constructs 1.2 Assignments based on functions, modules and packages 1.3 Assignments based on object oriented programming 1.4 Assignments based on exception handling, multithreading 1.5 Assignments based on python libraries 1.6 Assignments based on database
2	**Data Structure and Algorithms** 2.1 Assignments based on linked list, stack and queue 2.2 Assignments based on tree and graph 2.3 Assignments based on greedy algorithms 2.4 Assignments based on divide and conquer technique 2.5 Assignments based on dynamic programming
3	**Advanced Database Management System** 3.1 Assignments based on Data Definition Language and Transaction Control Language 3.2 Assignments based on Data Manipulation Language 3.3 Assignments based on Structured Query Language (SQL) 3.4 Assignments based on Mongodb(CRUD Operations) 3.5 Assignments based on Graph Databases.

Program: MCA (First Year)	**Semester: I**
Course Name: Mini Project	**Course Code: ITP11**
Course Type: Project Work (PROJ)	**Credit Points: 3**

Course Objectives:
1. To expose the students to use software engineering approach to analyze and formulate the real-world problem
2. To develop practical ability and knowledge about tools/techniques in order to solve the real-world problems
3. To gain deeper understanding in specific domain areas
4. To inculcate the skills of team work

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5. To gain the insight of technical writing

Course Outcomes with Blooms Level
Student will be able to
CO1: Develop a Software Requirements Specifications (SRS) using IEEE Guidelines.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3				3					

Guidelines for Mini Project

1. Students are expected to develop a Software Requirements Specifications (SRS) using IEEE Guidelines.
2. A student is required to present the progress of the Mini Project work during the semester as per the schedule provided by the Project Coordinator.
3. A student should submit a brief project report (20-25 pages) as per the guidelines of IEEE Guide for Software Requirements Specifications
4. Project reports duly signed by the Guide and HOD need to be submitted during examination.
5. A student should be able to explain the SRS at the time of evaluation.
6. A student should build a single module based on the SRS and guidelines given by the project coordinator.
7. Evaluation of mini projects shall be done for 75 marks.
8. Students may also start the mini project work as soon as the previous semester concludes.
9. Under this mini-project students are not restricted to software development projects only. There is flexibility to conduct any of the following work during that semester as a fulfillment of requirements of projects provided student has done substantial work which can be justified
   a. Industry Internship /Interdisciplinary Project
   b. Start-up Idea with Proof of Concept (POC)
   c. Paper Publication/Copyright
   d. Achievement in National/International Project competition/Hackathon/ Business Plan Competitions
   e. Any other activity fulfilling need and objectives of Mini Project with the prior permission of internal academic panel

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Course References:

    I.   **Reference Books**

           1. https://opac.library.iitb.ac.in/cgi-bin/koha/opac-detail.pl?biblionumber=128751

    II.   **Websites**

           1. https://ieeexplore.ieee.org/document/720574

    III.   **Other (Certification course/MOOC etc)**

           1. https://archive.nptel.ac.in/courses/106/105/106105182/

Program: MCA (First Year)	**Semester: I**
Course Name: Value Added Course	**Course Code: EC11**
Course Type: Professional Elective Course (PEC)	**Credit Points: 2**

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Value Added Courses (EC11)	
VAC	Programming Logic and Techniques
VAC	Django Framework
VAC	Distributed Computing
VAC	Flask Framework
VAC	Advanced Operating System

Program: MCA (First Year)	**Semester: I**
Course Name: MOOC-I	**Course Code: EC12**
Course Type: Professional Elective Course (PEC)	**Credit Points: 1**

Following is the suggestive list for MOOC-I elective courses on SWAYAM and NPTEL platform.

MOOC- I (EC12)	
PEC	Digital Marketing- SEO
PEC	Linux Shell Programming
PEC	Data Visualization (Power BI, Tableau)
PEC	Web Technology (HTML, CSS, JavaScript)
PEC	Data Warehousing (ETL, OLAP)
PEC	Enterprise Resource Planning (ERP)
PEC	Foundation of Stock Market Investing
PEC	Accountancy and Financial Management
PEC	Multidisciplinary Course for holistic development

SEMESTER II

Program: MCA (First Year)	**Semester: II**
Course Name: Java Programming	**Course Code: IT21**
Course Type: Professional Core Course (PCC)	**Credit Points: 3**

Course Objectives:

1. To familiarize the student with the concepts and principles of Java programming.
2. To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, interfaces
3. To learn implementation of exception handling, collection framework in Java programming
4. To enable the student to develop GUI using Swing and event handling.
5. To enable the student to develop a web application using Servlet and JDBC

Course Outcomes with Blooms Level

Student will be able to

CO1: Understand Basic Concepts and constructs of OOP and Java

CO2: Describe interface, packages and exception handling

CO3: Explain collection framework

CO4: Develop GUI using Swing and event handling mechanism

CO5: Create web application using Servlet and JDBC

Mapping of Course Outcomes to Program Outcomes

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

Prerequisites:

Fundamentals of programming concepts such as loops, conditions, operators, etc., Logical thinking

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required

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1	**Java Programming Constructs**	25	12
	1.1 Fundamentals of OOP		
	1.1.1 Inheritance and its types - Single, Multilevel and Hierarchical Inheritance , super keyword		
	1.1.2 Polymorphism and its types - Method Overloading and Method overriding		
	1.1.3 Abstraction		
	1.1.4 Encapsulation - Accessors and Mutator Methods		
	1.2 Class - Defining a class structure with data members		
	1.3 Object - Creating and operating objects, referencing object		
	1.4 Constructor - Types of constructor, Constructor chaining		
	1.5 Methods - Defining Methods, Argument Passing Mechanism		
	1.6 Use of "this" reference		
	1.7 Access Specifiers - public, private, protected, default		
	1.8 Modifiers - final, static, abstract and their use		
2	**Interfaces, Packages and Exception Handling**	20	10
	2.1 Interface - Importance, definition, structure		
	2.2 Implementing an Interface		
	2.3 Marker Interfaces		
	2.4 Abstract class		
	2.5 Packages - Introduction and Creating Package, scope of package, naming conventions of package		
	2.6 Importing Package / Class from package		
	2.7 java.io package for user input/output and Scanner class		
	3.8 java.util.regex package		
	2.9 Exception Handling using try, catch, finally, throws, throw		
	2.10 User defined exceptions		
3	**The Collection Framework**	15	6
	3.1 Introduction to Collection Framework and java.util package		
	3.2 Collections of Objects		
	3.3 Collection Types, Sets, Sequence, Map		
	3.4 Understanding Hashing		
	3.5 Use of ArrayList & Vector		
4	**GUI Programming using Swing and Event Handling**	20	8
	4.1 Introduction to Swing class and Features of Swing class		

		Web application development using Servlet and JDBC		

		4.2 Swing Component Classes - JButton, JLabel, JTextFiled, JComboBox, JSlider, etc 4.3 Creating forms using Swing components 4.4 Layout Manager Classes - Border, Grid, Flow, Box, Card, GridBag,Group,Spring,ScrollPanel 4.5 Event- Handling Process 4.6 The Delegation Model of Event Handling 4.7 Event Classes, Event Sources, Event Listeners 4.8 Adapter Classes as Helper Classes in Event Handling		
5	**Web application development using Servlet and JDBC** 5.1 Introduction to Servlet 5.2 Servlet life cycle 5.3 Developing and Deploying Servlets, Exploring Deployment Descriptor (web.xml) 5.4 Handling Request and Response. 5.5 Introduction to JDBC 5.6 JDBC Drivers & Architecture 5.7 CRUD operation Using JDBC	**20**	**9**
	Total	**100**	**45**

Course References:
  I.   Reference Books
     1. Java Complete Reference Schildt Herbert, TMH.
     2. Java Fundamentals (SIE), Schildt Herbert, TMH
     3. The Complete Reference JSP, Phil Hanna, TMH
     4. JDBC, Servlet and JSP, Black Book, Santosh Kumar K. Dremtech publication
     5. Head First Servlets and JSP, 2nd Edition by Bert Bates, Bryan Basham, Kathy Sierra
     6. OCJP Oracle Certified Programmer for Java Study Guide by Kathy Sierra and Bert Bates.
     7. A Programmer's Guide to Java OCJP Certification (A Comprehensive Primer) by Khalid A. Mughal and Rolf W. Rasmussen.
     8. Java Server Programming Java Ee &(J2EE 1.7), Black Book, Wiley publications

  II.   Websites
     1. www.javatpoint.com
     2. www.oracle.com

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3. www.tutorialspoint.com
4. www.geeksforgeeks.org/java

III. Other (Certification course/MOOC etc)

1. OCA- Oracle Certified Associate
2. OCP- Oracle Certified Professional

Program: MCA (First Year)	Semester: II
Course Name: Full Stack Development	Course Code: IT22
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:

1. To learn server side fundamentals and apply them to the creation of dynamic websites
2. To use Node.js environment for server side programming
3. To learn ExpressJS is web framework that enables you to design a web application to handle a variety of different HTTP demands
4. To learn and understand how to connect and communicate with MongoDB with Node. js driver library
5. To study React JS and use it for creating user interfaces

Course Outcomes with Blooms Level

Student will be able to

CO1: Understand Node.js environment and REPL environment

CO2: Use Node. js to create server-side web applications

CO3: Design web pages using Express web application framework

CO4: Demonstrate use of MongoDB with Node JS

CO5: Develop UI components using react JS

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	2		3		2					
CO2		2	2		3		2					
CO3		2	2		3		2					
CO4		2	2		3		2					
CO5		2	2		3		2					

Prerequisites:

JavaScript, HTML, CSS

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required
1	**Introduction to NodeJS and Getting Started** 1.1 What is Node JS? 1.2 Advantages of Node JS 1.3 Traditional Web Server Model 1.4 Node.js Process Model 1.5 Install Node.js on Windows 1.6 Working in REPL 1.7 Functions 1.8 Error Handling	10	4
2	**NodeJS Development Essentials** 2.1 Modules in NodeJS 2.2 Node Package Manager (NPM) 2.3 Web Server Creation 2.4 File Handling 2.5 Events 2.6 Sync vs Async programming in NodeJS	20	8

3	**Express JS** 3.1 Introduction to Express 3.2 Environment Setups 3.3 Express JS Routing 3.4 Express JS HTTP Methods 3.5 Express JS URL Building 3.6 Express JSMiddleware 3.7 Express JS Form Data 3.8 Express JS RESTful API's 3.9 Express JS Scaffolding 3.10 HTTP Response Codes 3.11 Using Postman tool for API Testing	25	10
4	**Working with MongoDB** 4.1 Connecting to MongoDB from NodeJS 4.2 Introduction to Mongoose Schemas 4.3 Performing CRUD in NodeJs 4.4 Connection Pooling and other configurations 4.5 Hosting MongoDB on Mongo Atlas	15	4
5	**React JS** 5.1 Introduction to React JS 5.2 Overview of JSX 5.3 React JS Forms and UI 5.4 React JS Component Lifecycle 5.5 React Props and State 5.5 Routing in React JS 5.6 Event Handling 5.7 React Hooks 5.8 Introduction to Redux	30	14
	Total	100	45

Course References:
I.   **Reference Books**
1. Beginning MERN Stack By Greg Lim - Technologist & Author of Programming Books Development

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2. Full-Stack React Projects Modern web development using React 16, Node, Express, and MongoDB By Shama Hoque - Software developer & mentor with a Master's in Software Engineering
3. Beginning Node.js by Basarat Ali Syed.
4. Angular: Up and Running- Learning Angular, Step by Step by Shyam

II. **Websites**
   1.**https://www.w3schools.com/mongodb/**
   2. **https://www.tutorialspoint.com/nodejs/index.htm**
   3.**https://www.w3schools.com/REACT/react_jsx.asp**
   4.**https://www.tutorialspoint.com/expressjs/index.htm**
   5. Server-side Development with NodeJS, Express and MongoDB – The Hong Kong University of Science and Technology
   https://www.coursera.org/learn/server-side-nodejs

III. **Other (Certification course/MOOC etc)**
   1. Introduction to MongoDB
      https://www.coursera.org/learn/introduction-to-mongodb
   2. Learning MEAN Stack by Building Real world Application Specialization
      https://www.coursera.org/specializations/mean-stack

Program: MCA (First Year)	Semester: II
Course Name: Cyber Security	Course Code: IT23
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:
1. To understand the fundamentals of Cyber Security and Cyber Space
2. To explore cyber security types
3. To examine various types of cyber attacks and medium of defence
4. To learn Cyber Security Audit
5. To examine tools and techniques used in Cybersecurity

Course Outcomes with Blooms Level

Student will be able to

CO1: Understand the importance of cyber security fundamentals and learning about Cyber Space

CO2: Discuss various cyber security types

CO3: Examine various cyber attacks with defence techniques

CO4: Analyze the security audit acts showcasing real life examples.

CO5: Apply the tools and techniques for implementing cybersecurity

Mapping of Course Outcomes to Program Outcomes

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

Prerequisites:

Topologies, LAN, MAN, WAN, Computer Organization

Course Structure:

Unit No	Description	Weightage (%)	No. of sessions required
1	**Introduction to CyberSpace and Cyber Security** 1.1 Introduction of cybersecurity concepts, importance, and challenges in the digital age 1.2 Threats and its types - Interruption, Interception, Modification, Fabrication	15	5

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	1.3 What is digital asset(s) 1.4 What is security incident 1.5 Difference between Information and Data security		
2	**Cyber Security Classification** 2.1 Computer Security 2.2 Application security 2.3 Cloud security 2.4 Data security 2.5 Endpoint security 2.6 IoT(Internet of the Things) security 2.7 Mobile security 2.8 Network security	20	8
3	**Cyber Attack & Defense** 3.1 Introduction to Cyber Crime and Cybercriminals 3.2 Criminals Plan and Cyber Attacks: Reconnaissance, Passive Attack, Active Attacks, Scanning/Scrutinizing gathered Information, Attack 3.3 Types and subtypes of attack: DoS, DDoS, Phishing, Penetration, Brute force, ransomware 3.4 Recent trends of attacks (Case study) Cardening, Cloning, Bot 3.5 Cyber hygiene 3.6 Identification and defence tech for attacks	25	12

4	**Security Audit**
	4.1 Need and Scope of auditing in cyber security.
	4.2 Internal and external security audit.
	4.3 Types of IT/cyber security audits
	    -Compliance
	    - Penetration
	    - Risk Assessment
	4.4 Introduction to IT Act
		20	8

5	**Implementation of Cyber Security** 5.1 Cyber Security Asset Management 5.2 2 Factor, 3 Factor and Multifactor Authentication 5.3 Encryption Decryption techniques for Cyber Security 5.4 Test Password Strength 5.5 Integrity Checker	20	12

	5.6 Simple Malware Scanner 5.7 Key-logger projects 5.8 Network traffic analysis		
	Total	**100**	**45**

Extra Reading for Self Learning:

Endpoint Security, VLan Threats, Network Security Infrastructure, Host-Based Intrusion Prevention, Cyber Security Countermeasures, Network Security Testing/Tools, Cyber Kill Chain, Diamond Model, Disaster Recovery, Cyber Threat Management, NetDef

Course References:

I.   Reference Books

1.   Introduction to cyber security by Jeetendra Pande
2.   Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley
3.   Cyber security fundamentals, Rajesh Kumar goutam, BPB, May 2021
4.   IT Audit, Control, and Security by Robert R. Moeller

II.   Websites

1.   https://onlinecourses.swayam2.ac.in/cec20_cs15/preview

III.   Other (Certification course/MOOC etc)

1.   CERT-IN
2.   Mooc courses on cyber security and auditing

Program: MCA (First Year)	Semester: II
Course Name: Software Project Management	Course Code: IT24
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:

1. To understand Agile Project Management

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2. To learn Agile Project Management Framework.

3. To study various roles of Agile Team and Schedules

4. To discuss project planning and tracking.

5. To study various agile tools

Course Outcomes with Blooms Level

Student will be able to

CO1: Learn the philosophy, principles and lifecycle of an agile project.

CO2: Demonstrate Agile Management Tools and Apply agile project constraints and trade-offs for project estimations

CO3:Explain Agile Schedules for robust project management

CO4: Classify Project Tracking and Interpretation for Progress Report

CO5: Implement agile tools for project management

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2						2	2				
CO2	2			3	3		2	2				
CO3	2	3		3	3		2	2				
CO4	2	3		3	3		3	2				
CO5	2						3	2				

Prerequisites:

 Software Engineering Lifecycle,various processes and different models of software engineering

Course Structure

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Unit No	Description	Weightage (%)	No. of sessions required
1	**Introduction to Agile Project Management** 1.1 Agile Project Management V/S Traditional Project Management 1.2 Introduction and Definition of Agile 1.3 Agile Project Life Cycle 1.4 Agile Manifesto: Agile Principles 1.5 Structure and Roles of an Agile Team 　　1.5.1 Scrum Master 　　1.5.2 Product Owner 　　1.5.3 Development Team	10	5
2	**Agile Project Management Framework** 2.1. User stories 2.2 Story points 　　2.2.1 Techniques for estimating Story Points 2.3 Product Vision and Product Roadmap 2.4 Product Backlog 　　2.4.1 Techniques for estimating product backlog 2.5 Sprint Backlog 2.6 Plan Product Releases 2.7 Product Prioritization 　　2.7.1 Techniques for estimating product backlog prioritization 2.8 Sprint Velocity 2.9 Swim lanes 2.10 Minimum Viable Product (MVP) Note:Case studies should be covered on User Stories, product- sprint backlog and MVP	25	12
3	**Tracking Agile Project and Reports** 3.1 Introduction 3.2 PL Reports and Execute Iteration 3.3 Facilitate Retrospective, Making Team Decisions and Closing out Retrospective 3.4 Agile Reports 　　3.4.1 Daily	20	8

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CAREER COURSES (IMCC), PUNE
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[CGPA-3.32] in Cycle 1

	3.4.2 Sprint Burn down Chart and Reports 3.4.3 Benefits of Agile Project Management Note: Demonstrate using any relevant tool		
4	**ITIL** 4.1 ITIL principles and framework 4.2 ITIL service management and project management 4.3 Demonstration using tool service desk/OTRS	20	8
5	**Implementation with Agile Tools** 5.1 Implementation using Kanban Board 5.2 Designing Scrum Task Board and Burn Down Chart 5.3 Project workflow management using JIRA/Trello/Asana	25	12
	Total	**100**	**45**

Extra Reading for Self Learning:

Various software methodologies, Risk Management, Change Management, Agile project management delivery & methodology framework, Personnel Management, Release & iteration planning, eXtreme Programming (XP), Values and Principles, Team Dynamics and Collaboration, Agile Metrics, Value Driven Development and Dynamic System Development.

Course References:
I.   Reference Books

1. Mark C. Layton, Steven J. Ostermiller
2. Agile Estimating and Planning by Mike Cohn Robert C Martin Series
3. Introduction to Software Project Management by Adolfo Villafiorita, CRC Press
4. Agile Project Management with Scrum By Ken Schwaber, Microsoft Press © 2004
5. Agile Project Management QuickStart Guide : The Simplified Beginner's Guide to Agile Project Management by ClydeBank Business
6. Agile Product Management with Scrum: Creating Products that Customers Love by Roman Pichler.
7. Scrum Mastery: From Good to Great Servant-Leadership by Geoff Watts
8. Agile Project Management for Dummies by Mark C. Layton
9. The Agile Enterprise: Building and Running Agile Organizations by Mario E. Moreira

10. Scrum: The Art of Doing Twice the Work in Half the Time by Jeff Sutherland

11. Essential Scrum: A Practical Guide to the Most Popular Agile Process by Kenneth S. Rubin

12.Agile Project Management with Kanban By Eric Brechner

13.Agile Constraints: Creating and Managing Successful Projects with Scrum, Multiple authors

II. **Websites**
1. https://learning.tcsionhub.in/
2. https://www.agilealliance.org
3. http://www.pmi.org
4. https://github.com/topics/kanban
5. https://www.opensourcescrum.com/
6. https://www.scrum.org/resources
7. https://www.tutorialspoint.com/agile/index.htm
8. https://www.atlassian.com/agile
9. https://www.javatpoint.com/agile
10. https://www.guru99.com/agile-testing-course.html
11. https://www.visual-paradigm.com/tutorials/agile-tutorial/

III. **Other (Certification course/MOOC etc)**
1. Project Management Professional (PMP)
2. PMI-ACP(Agile Certified Practitioner)
3. Associate in Project Management
4. BVOP Certified Project Manager
5. Certified Associate in Project Management (CAPM)
6. Certified Project Director
7. Certified Project Management Practitioner (CPMP)
8. Certified Project Manager (CPM)
9. Certified ScrumMaster (CSM)
10. CompTIA Project+
11. Master Project Manager (MPM)
12. PRINCE2 Foundation/PRINCE2 Practitioner
13. Professional in Project Management (PPM)
14. Project Management in IT Security (PMITS)
15. APMG International
16. Strategyex Certificate (Associate or Master's) in Agile

17. International Consortium for Agile (ICAgile)
18. Agile Certification Institute
19. Scaled Agile Academy
20. Scrum Alliance
21. Certified Agile Project Manager (IAPM)

Program: MCA (First Year)	Semester: II
Course Name: Research Methodology	Course Code: IT25
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:
1. To develop the research aptitude among the researchers
2. To develop the most appropriate methodology for his/her research
3. To make them familiar with different research methods and techniques.
4. To enhance the ability of students to conduct research ethically and meticulously.
5. To prepare the students for future research endeavors.

Course Outcomes with Blooms Level

Student will be able to

CO1: Formulate research problem

CO2: Examine literature review and find research gaps to finalize research objectives.

CO3: Demonstrate basic data analytics techniques

CO4: Develop skills in qualitative and quantitative data analysis and presentation.

CO5: Execute a quality research paper / patents in science and technology.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3				2					

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CO2	3	3	3				2					
CO3	3	3	3				2					
CO4	3	3	3				2					
CO5	3	3	3				2					

Prerequisites:

No specific requirement

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required
1	**Research Methodology** 1.1 Qualitative and Quantitative Research 1.2 Problem Identification & Formulation 1.3 Questionnaire Designing 1.4 Hypothesis Testing – Logic & Importance	30	15
2	**Sampling** 2.1 Sampling 2.2 Sampling Techniques	15	7
3	**Data Analysis** 3.1 Data Preparation 3.2 Data Testing	25	8
4	**Research Publications** 4.1 Writing research paper 4.2 Writing a research proposal 4.3 Intellectual property rights, academic integrity and anti plagiarism.	30	15

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[CGPA-3.32] in Cycle 1

		100	45
Total			

Extra Reading for Self Learning:

Research Methodologies, Research Designs, Measurement and Scaling Techniques, Methods of Data Collection, Hypothesis Testing (parametric as well as non-parametric), ANOVA and multivariate analysis, Research Report Writing, SPSS Tool,

Course References:

I.   **Reference Books**

1.   C. R. Kothari, Research Methodology – Methods and Techniques, (Second Revised Edition), New Age International Publications

2.   'The Statistical Analysis of Experimental Data' by John Mandel, Dover Publications (2012).

3.   'Research Methodology Methods and Techniques' by C.R. Kothari, New Age International (P) Ltd. Publishers, 2nd revised edition (2004).

4.   Michael Alley, The Craft of Scientific Writing (3rd Edition), Springer, New York, 1996

5.   Philip Reubens (General editor), Science and Technical Writing – A Manual of Style (2nd Edition), Routledge, New York, 2001

II.   **Websites**

1.   https://research-methodology.net
2.   https://resources.nu.edu/methods

III.   **Other (Certification course/MOOC etc)**

1.   https://onlinecourses.nptel.ac.in/noc22_ge08/preview
2.   https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/330
3.   https://www.coursera.org/learn/research-methodologies

Program: MCA (First Year)	Semester: II
Course Name: Practical based on Java Programming, Full Stack Development and Cyber Security	Course Code: ITL21
Course Type: Practical (PR)	Credit Points: 3

Course Objectives:
1. To build efficient programming skills in students.
2. To impart the basic and advanced concepts of Java
3. To learn concepts of web development
4. To understand concepts of network programming

Course Outcomes with Blooms Level

Student will be able to

CO1: Solve real world problems using Java

CO2: Build dynamic, scalable web applications using MongoDB, Express.js, React, and Node.js

CO3: Demonstrate Cyber Security threats.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2		2		2					
CO2	3	3	2		2		2					
CO3	3	3	2		2		2					

Prerequisites

Fundamentals of programming concepts such as loops, conditions, operators etc, HTML, CSS, basics of java/python programming

Sr. No.	List of Practicals
1	**Java Programming** 1.1 Assignments based on basic constructs 1.2 Assignments based on Interfaces, Packages and Exception Handling 1.3 Assignments based on Collection Framework 1.4 Assignments based on Swing and Event Handling 1.5 Assignments based on Servlet and JDBC
2	**Full Stack Development** 2.1 Assignments based on Node.js 2.2 Assignments based on Express framework 2.3 Assignments based on MongoDB with Node.js 2.4 Assignments based on react JS
3	**Cyber Security** 3.1 Assignment based on Scanning/Scrutinizing 3.2 Assignment based on Threats and Vulnerabilities 3.3 Assignment based on Risk Assessment and Reporting

Program: MCA (First Year)	**Semester: II**
Course Name: Mini Project (Research Project)	**Course Code: ITP21**
Course Type: Project Work (PROJ)	**Credit Points: 3**

Course Objectives:
1. To expose the students to use software engineering approach to analyze and formulate the real-world problem
2. To develop practical ability and knowledge about tools/techniques in order to solve the real world problems
3. To gain deeper understanding in specific domain areas
4. To inculcate the skills of team work

42

5. To gain the insight of technical writing

Course Outcomes with Blooms Level

Student will be able to

CO1: Create working project using tools and techniques learnt in this semester.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3				3					

Guidelines for Mini Project

1. Students are expected to develop a working project using tools and techniques learnt in the semesters.
2. The student may take up the mini project. in the second semester based on the courses learnt in that semester and for every next semester the mini project may be based on the courses learnt in the current semester along with all the subjects learnt in earlier semesters.
3. Students may develop mini projects as a research project based on their interest in the domain.
4. Selected project/module must have relevant scope as per the marks assigned and as per the guidelines given by project coordinator
5. Internal guide should monitor and evaluate the progress of the project on an individual basis through handwriting workbooks (Project Diary) maintained by students containing various project milestones with learnings and remarks from the internal guide for concurrent evaluation.
6. Students are expected to show a working demo of the project during final evaluation.
7. Students are expected to upload mini-project on GITHUB as project repositories of the institution.
8. Students are expected to submit the soft copy of the mini project report as a part of final submission.
9. A student should develop the SRS for the project.
10. A student is required to present the progress of the Mini Project work during the semester as per the schedule provided by the Project Coordinator.
11. Project reports duly signed by the Guide and HOD need to be submitted during examination.

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CAREER COURSES (IMCC), PUNE
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Affiliated to Savitribai Phule Pune University

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[CGPA-3.32] in Cycle 1

12. Evaluation of mini projects shall be done for 75 marks.
13. Under this mini-project students are not restricted to software development projects only. There is flexibility to conduct any of the following work during that semester as a fulfillment of requirements of projects provided the student has done substantial work which can be justified.
   a) Industry Internship /Interdisciplinary Project
   b) Start-up Idea with Proof of Concept (POC)
   c) Paper Publication/Copyright
   d) Achievement in National/International Project competition/Hackathon/ Business Plan Competitions.
   e) Any other activity fulfilling the needs and objectives of Mini Project with the prior permission of the internal academic panel.

Course References:

I.   **Reference Books**
   1. https://opac.library.iitb.ac.in/cgi-bin/koha/opac-detail.pl?biblionumber=128751

II.   **Websites**
   1. https://ieeexplore.ieee.org/document/720574

III.   **Other (Certification course/MOOC etc)**
   1. https://archive.nptel.ac.in/courses/106/105/106105182/

Program: MCA (First Year)	**Semester: II**
Course Name: Value Added Course	**Course Code: EC21**
Course Type: Professional Elective Course (PEC)	**Credit Points: 2**

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[CGPA-3.32] in Cycle 1

Value Added Courses (EC21)	
VAC	UI/UX Design
VAC	Bootstrap
VAC	Object Oriented Design
VAC	Database Administration
VAC	Ethical Hacking

Program: MCA (First Year)	**Semester: II**
Course Name: MOOC-II	**Course Code: EC22**
Course Type: Professional Elective Course PEC)	**Credit Points: 1**

Following is the suggestive list for MOOC-II elective courses on SWAYAM and NPTEL platform.

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MOOC- II (EC22)	
PEC	Green Computing
PEC	Computer Graphics and Multimedia
PEC	CRM
PEC	ECommerce
PEC	Cyber Forensics
PEC	Big Data Frameworks and Technologies
PEC	Investment and Trading Strategies
PEC	Edge Computing
PEC	Multidisciplinary Course for holistic development

SEMESTER III

Program: MCA (Second Year)	**Semester: III**
Course Name: Mobile Application Development	**Course Code: IT31**
Course Type: Professional Core Course (PCC)	**Credit Points: 3**

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Course Objectives:

    1. To facilitate students to understand Flutter and its use cases

    2. To learn implementation on mobile application development

    3. To enable inculcation on Flutter tool

    4. To learn implementation of user interaction and navigation

    5. To explore flutter application and its testing

Course Outcomes with Blooms Level

    Student will be able to

    CO1: Identify various concepts of mobile programming that make it unique from programming for other platforms

    CO2: Critique mobile applications on their design pros and cons

    CO3: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces

    CO4: Program mobile applications for the any operating system that use basic and advanced phone features

    CO5: Deploy applications to any marketplace for distribution.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3						2					
CO2	3	2	3		3		2					
CO3	3	2	3		3		2					
CO4	3	2	3		3		2					
CO5	3	2	3		3		2					

Prerequisites:

 Object Oriented Programming concepts

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required
1	**Introduction to Flutter** 1.1 What is Flutter? 1.2 Why Use Flutter? 1.3 Setting Up Your Development Environment 1.4 Understanding the Dart Programming Language 1.5 Creating Your First Flutter App	10	5
2	**Widgets in Flutter** 2.1 Introduction to Widgets 2.2 Types of Widgets 2.3 Building Custom Widgets 2.4 Working with Layouts -Styling Widgets -Advanced Widget Techniques -Responsive Widgets	30	10
3	**State Management in Flutter** 3.1 Understanding App State 3.2 Stateful Widgets and the Build Method 3.3 Provider Package for State Management 3.4 BLoC (Business Logic Component) Pattern 3.5 Scoped Model for Global State Management	25	10
4	**User Interaction and Navigation** 4.1 Handling User Input 4.2 Implementing Buttons, Text Fields, Forms 4.3 Routing and Navigation in Flutter 4.4 Passing Data Between Screens 4.5 Building Animated UIs	15	10
5	**Working with Data** 5.1 Fetching Data from APIs 5.2 Parsing JSON Data 5.3 Local Data Storage 5.4 Working with Databases using Firebase and SQlite 5.5 Displaying Data in Lists	10	5

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A+
NAAC
[CGPA-3.32] in Cycle 1

6	**Advanced Topics** 6.1 Testing Flutter Applications 6.2 Deploying Flutter Apps 6.3 Clean Architecture	10	5
	Total	100	45

Course References:

I.   **References**
1. Flutter Complete Reference 2.0: The ultimate reference for Dart and Flutter by Alberto Miola
2. Beginning App Development with Flutter: Create Cross-Platform Mobile Apps, Rap Payne
3. Beginning Flutter: A Hands On Guide to App Development, Marco L. Napoli

   II. **Websites**
1. https://flutter.dev/learn
2. https://dev.to/marwamejri/flutter-clean-architecture-1-an-overview-project-structure-4bhf
3. Learn Google Flutter Fast: 65 Example Apps by Mark Clow

III. Certification:
1. Recognized Mooc platforms

Program: MCA (Second Year)	Semester: III
Course Name: Data Science and Machine Learning	**Course Code: IT32**
Course Type: Professional Core Course (PCC)	**Credit Points: 3**

Course Objectives:
1. To be able to formulate machine learning problems corresponding to different applications..
2. To understand fundamental concepts of machine learning and its various algorithms.
3. To apply ML algorithms on given data and interpret the results obtained.
4. To understand various strategies of generating models from data and evaluating them.
5. To be able to formulate deep learning problems corresponding to different applications..

Course Outcomes with Blooms Level

Student will be able to

CO1: Analyze the given dataset and apply the data analysis concepts and data visualization

CO2: Compare an appropriate pattern analysis tool for analyzing data in a given feature space

CO3: Apply pattern recognition and machine learning techniques such as classification, regression and feature selection to practical applications and detect patterns in the data.

CO4: Evaluate and compare various techniques like Support Vector Machines, Decision Trees, and Instance Based Learning on different datasets.

CO5: Identify appropriate algorithms given a practical task using Deep Learning Techniques.

Mapping of Course Outcomes to Program Outcomes

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

Prerequisites:
Statistical Techniques, Probability and Python Programming

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required

1	**Data Analysis**
	 1.1 Data Manipulation: Numpy and Pandas
	 1.2 Data Visualization
	      Matplotlib: creating different graphs
	      Seaborn: advanced visualization
	 1.3 Data Analysis with Scipy
	 1.4 Machine Learning with Scikit-Learn
		10	6

2	**Foundation of Machine Learning** 2.1 Machine Learning 2.2 Machine Learning Vs Statistical Learning 2.3 Type of Machine Learning - 2.4 Validation Techniques 2.5 Feature Selection 2.6 Dimensionality reduction	10	6

3	**Supervised Machine Learning**
	3.1 Regression
	      3.1.1 Linear Regression,
	      3.1.2 Logistic Regression,
	      3.1.3 Ordinary Least Square Regression
	      3.1.4 Evaluation of Regression Algorithm
	3.2 Classification
	      3.2.1 Naïve Bayes Classifier
	      3.2.2 K-Nearest Neighbors
	      3.2.3 Support Vector Machines
	      3.2.4 Decision Tree
	      3.2.5 Evaluation of Classification Algorithm
	3.3 Ensembles methods
	      3.3.1 Bagging & boosting and its impact on
	          bias and variance
	      3.3.2 Random Forest
		30	12

4	**Unsupervised Machine Learning**
	4.1 Representation learning – PCA
	4.2 Clustering
	      4.2.1 Different clustering methods
	      4.2.2 K-means/Kernel K-means
	4.3 Bayesian estimation, Gaussian Mixture Model - EM algorithm.
		20	6

5	**Deep Learning**
	5.1. Fundamentals of Deep Learning Networks
	5.2. Deep learning Problem types
	      5.2.1. ANN
	      5.2.2. CNN
	      5.2.3. RNN
	      5.2.4. GAN
		30	15

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INSTITUTE OF MANAGEMENT & CAREER COURSES (IMCC), PUNE (AUTONOMOUS)
Affiliated to Savitribai Phule Pune University

NAAC A+ ACCREDITED WITH GRADE
[CGPA-3.32] in Cycle 1

	5.2.5. NLP 5.3. Building blocks of Deep learning 5.4. Classification and Detection 5.5 ML Model Pipeline Process			
	Total	**100**	**45**	

Course References:
I.   **Reference Books**

      1. Statistical Methods - S. P. Gupta

      2. Statistics and Data Science -Dr. Swapnaja Patwardhan, Dr. Minakshi More, Dr. Mukul Kulkarni, Dr. Santosh Deshpande, Dr. Ravikant Zirmite.

      3. Introduction of machine Learning - Ethem Alpaydin

      4. Understanding Machine Learning: From Theory To Algorithms - Shai Shalev-Shwartz, Shai Ben-David

      5. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron

      6. Machine Learning for Absolute Beginners by Oliver Theobald

      7. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm", O'Reilly, 2017.

      8. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press, 2016**.**

II.   **Websites**

      1. Towards Data Science: https://towardsdatascience.com/

      2. KDnuggets: https://www.kdnuggets.com/

      3. Analytics Vidhya: https://www.analyticsvidhya.com/

      4. Data Science Central: https://www.datasciencecentral.com/

      5. Medium: https://medium.com/

III.   **Other (Certification course/MOOC etc)**

      https://www.coursera.org/specializations/machine-learning-introduction

      https://www.coursera.org/specializations/statistical-inference-for-data-science-applications

      https://www.coursera.org/learn/machine-learning

      https://www.coursera.org/specializations/deep-learning

Program: MCA (Second Year)	Semester: III
Course Name: Software Testing and Quality Assurance	Course Code: IT33
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:
1. To understand the principles of software development emphasizing processes and activities of quality assurance
2. To study fundamental concepts in software testing, including software testing objectives, process, strategies and methods.
3. To understand test design techniques based on functionality and structure of software
4. To understand test planning, monitoring and control process
5. To gain the techniques and skills on how to use software testing tools to support software testing activities

Course Outcomes with Blooms Level

Student will be able to

CO1: Understand the basic concepts of testing and quality

CO2: Demonstrate specific software tests with well-defined objectives and targets

CO3: Explain static and dynamic testing techniques

CO4: Construct a test plan & test cases for an application

CO5: Test software for performance measures using automated testing tools

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3						2					

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CO2	3	3	3									
CO3	3	3					3					
CO4	3	3	3				2					
CO5	3		3		3		2					

Prerequisites:

      Programming language and database concepts, Software engineering and project life cycle.

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required
1	**Software Testing Fundamentals** 1.1 Definition & Objectives 1.2 Define - bug, defect, error, failure 1.3 Defect life cycle 1.4 Testing life cycle 1.5 SDLC 1.6 SDLC Models – V & V, Waterfall, Spiral 1.7 Introduction to quality engineering 1.8 Agile Testing Fundamentals and Methodology	15	7
2	**Testing Levels & Types** 2.1 Unit - Driver & Stub 2.2 Integration - Top down, Bottom up, Bi-directional 2.3 Performance - Load, Stress, Security, Client server testing 2.4 Acceptance - Alpha, Beta, 2.5 Regression testing, GUI testing Note: Should be explained with one web application case study	20	9

3	**Testing Strategies**	**20**	**9**
	3.1 Static Techniques:		
	3.1.1 Technical or Peer Review		
	3.1.2 Walkthrough		
	3.1. Inspection		
	3.2 Dynamic Testing:		
	3.2.1 Test Design Techniques-Black Box Testing Techniques:		
	3.2.1.1 Equivalence Partitioning		
	3.2.1.2 Boundary Value Analysis		
	3.2.1.3 Decision Table Testing		
	3.2.1.4 State Transition Testing		
	3.3 Test Design Techniques -White Box Testing Techniques		
	3.3.1 Statement coverage		
	3.3.2 Branch & Decision coverage		
	3.3.3 Path coverage		
4	**Test Management and Quality Engineering**	**25**	**11**
	4.1 Test Plan as per IEEE 829 standard test plan template		
	4.2 Test Cases as per IEEE 829 test case specification template		
	4.3 Test Management, Quality Engineering and Continuous Testing as per SAFe (Scaled Agile Framework) – Concepts under Built-In-Quality		
5	**Automation Testing & Tool**	**20**	**9**
	5.1 Introduction to manual testing		
	5.2 Automation testing & tools		
	5.3 Selenium tool - WebDriver and Test NG		
	Note: Hands on session using selenium tool		
	Total	**100**	**45**

Course References:

I.   Reference Books

1. Software Engineering: A Practitioner's Approach - Roger Pressman
2. Foundations of Software Testing by Rex black, Erik Van Veenendaal, Dorothy Graham (2012)- Cengage Learning: London UK, 3rd Edition
3. Software Engineering by Sommerville-Pearson,8thEdition
4. Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson Addison-Wesley, 2012. 2.
5. Effective Methods for Software Testing by William Perry- Wiley Pub, 3rd Edition.

II.   Websites

1. www.istqb.org
2. https://www.seleniumhq.org/
3. https://www.softwaretestingmaterial.com/selenium-tutorial/
4. https://www.toolsqa.com/selenium-tutorial/
5. www.guru99.com/software-testing.html
6. www.iist.org
7. https://scaledagileframework.com/built-in-quality/
8. https://www.istqb.org/certifications/agile-tester

III.   Other (Certification course/MOOC etc)

1. ISTQB Certification

Program: MCA (Second Year)	Semester: III
Course Name: Innovation and Entrepreneurship Development	Course Code: IT34
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:
1. To create entrepreneurship awareness within students.
2. To encourage students to become entrepreneurs
3. To enhance leadership and innovative skills in students to manage startups
4. To gain knowledge for financial aids available in market and through government schemes
5. Plan for setting up a startup and becoming an entrepreneur.

Course Outcomes with Blooms Level
Student will be able to

CO1: Discuss the scope of entrepreneurship and innovation

CO2: Summarize the ideation process and its implementation in entrepreneurship

CO3: Identify the ways in which IPR, patenting, trade marks works and various financial aids available for entrepreneurial setups

CO4: Summarize different aspects for growth of an enterprise

CO5: Prepare business plan for their entrepreneur idea

Mapping of Course Outcomes to Program Outcomes

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

Prerequisites:
No specific requirements

Course Structure

Unit No	Description	Weightage (%)	No. of sessions required
1	**Introduction to Entrepreneurship** 1.1 Meaning, Definition and concept of Enterprise 1.2 Entrepreneurship Development 1.3 Concepts of Intrapreneurship 1.4 Innovation and entrepreneurship 1.5 Why to become an Entrepreneur? 1.6 Types of entrepreneurs 1.7 Entrepreneur v/s Intrapreneur, 1.8 Entrepreneur Vs. Manager V/s Leadership 1.9 Factors affecting Entrepreneurship, Problems of Entrepreneurship 1.10 Role of Entrepreneurship in Economic Development 1.11 Make in India Project - Aims and awareness	15	6
2	**Idea generation & Prototype Development** 2.1 Process of Ideation - Definition, meaning, process, implementation 2.2 Business V/s Startup 2.3 How to generate Business Ideas? 2.4 Opportunities in different industries / Sector 2.5 What is an idea? 2.6 Idea generation Techniques - Mind Mapping, Reverse Thinking , Brainstorming, (Referring innovating an existing business idea in a different manner) 2.7 Difference between Invention and Innovation, and Perspective and Heuristic	25	12
3	**Business Plan and Business Pitch** 3.1 The business plan as an entrepreneurial tool 3.2 Elements of Business Plan 3.3 The Pitch-Preparing for your investor presentation 3.4 Elements of the Perfect Investment Pitch	30	15

58

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4	**The Financial Road Map:** 4.1 Role of Government in promoting Entrepreneurship 4.2 MSME policy in India 4.3 Start-up India, Make in India schemes 4.4 Various Government scheme 4.5 Investment, Angel, VC, NBFC, Community fund system and utilization of the investment i.e. ROI & Expenditure KRAs.	10	4
5	**Boosting the Enterprise** 5.1 Skills required for growth of an enterprise: 5.2 Communication Skills 5.3 Negotiation Skills 5.4 Risk management 5.5 Delegation & Team Management 5.6 Importance of failing 5.7 Intellectual Property Support System 5.8 Introduction to IPR 5.9 Copyrights, Trademarks, and Geographical Indications 5.10 Marketing Management 5.11 Analyzing markets, trends and customer mindsets. 5.12 Segmentation 5.13 Target Marketing & Positioning Marketing Mix	20	8
	Total	**100**	**45**

Extra Reading for Self Learning:

How to generate business ideas? Design thinking, Trademarks, Leadership styles, Delegations and team management, Core concepts of marketing

List of Activities:
1. Activity Based on Challenges of Entrepreneurship
2. Activity on Marketing Management (Online – Digital/Social & Off-Line – On Field)
3. Activity on Development and positioning of Idea
4. Activity based on Skill set required for successful Entrepreneurship

5. Activity based on Financial Roadmap

6. Activity based on Creativity and Problem solving

Idea generation tools can be considered as-
SCAMPER,Synectic, Role-Playing, Storyboarding, Brainwriting, Forced Relationship, Collaboration ,
Idea Generation Tools - Mindmeister, IdeasWatch,Javelin,Coggle

Course References:

    I.   Reference Books

        1. Ronnie Screwala – Dream with your eyes open
        2. Rashmi Bansal – Connect the dots
        3. Sanjay Kulkarni – Angle Investing
        4. Steel King: Laxmi Mittal by Prateeksha M Tiwary

    II.   Websites

        1. HarvardX website – This has various different FREE online courses which are very good for different businesses and aspects to go through.
        2. Inc.com
        3. Enterprenuer.com

    III.   Other (Certification course/MOOC etc)

    This can be designed specifically based on the expected outcome. HarvardX, Coursera, and Udemi do have such types of courses and certifications.

Program: MCA (Second Year)	Semester: III
Course Name: Principles of Cloud Management and Security	Course Code: IT35
Course Type: Professional Core Course (PCC)	Credit Points: 3

Course Objectives:

1. To introduce the fundamentals of cloud computing, its technologies, Challenges and Applications
2. To give Insights into the virtualization technologies and Architecture
3. To know the relationship between Cloud and SOA
4. To classify and evaluate Cloud Security Issues
5. To apply theory to practical knowledge by demonstrating the commercial cloud computing Infrastructures

Course Outcomes with Blooms Level

Student will be able to

CO1: Demonstrate the concepts of Cloud Computing and its Service Models & Deployment Models

CO2: Classify the types of Virtualizations

CO3: Describe the Cloud Management and relate Cloud to SOA

CO4: Describe the Moving Applications to the Cloud

CO5: Demonstrate practical implementation of Cloud computing

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2				3							
CO2	2				3							
CO3	2											
CO4	2				3							
CO5	2				3							

Prerequisites:

Topologies, Network types, Storage types, Computer storage and security

Course Structure

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Unit No	Description	Weightage (%)	No. of sessions required
1	**Fundamentals Of Cloud Computing:** 1.1 Introduction to Cloud, Characteristics, Advantages 1.2 Cloud Computing vs. Cluster Computing vs. Grid Computing 1.3 Cloud Service Models: IaaS, PaaS, SaaS characteristics, benefits and Applications, Comparison of SaaS, PaaS and IaaS 1.4 Cloud Deployment Models: Public, Private, Hybrid 1.5 Cloud Platforms: Google Cloud Platform, Microsoft Azure, AWS. Note-Hands On- how to access the Cloud via Big Cloud vendors' websites.	25	10
2	**Virtualization** 2.1 Introduction to Virtualization. Hypervisors its types 2.2 Types of Virtualizations: Server, Storage and Network with its Pros and Cons 2.3 Machine Image, Virtual Machine (VM) Note-Hands On-To Create a virtual machine on the various Big Cloud platforms.	20	9
3	**SOA & Cloud Management** 3.1 Service Oriented Architecture 3.2 Components of SOA: UDDI, WSDL 3.3 Web Services: SOAP and REST 3.4 Cloud APIs (RESTful)	15	8
4	**Moving Applications to the Cloud** 4.1 Cloud Migration Strategies and Process 4.2 Issues in Inter Cloud 4.3 Applications in the Clouds 4.4 Cloud Bursting. 4.5 Data Migration in Cloud 4.6 Quality of Services in cloud Computing	20	9

	4.7 Case study based on cloud migration strategies Note-Hands On: To demonstrate data migration in the cloud		
5	**Cloud Security** 5.1 Cloud Security Fundamentals 5.2 Cloud Security Architecture 5.3 Cloud Computing Security Challenges 5.4 Privacy and Security in Cloud 5.5 Identity Management and Access control Note-Hands-on-Demonstrate the commercial cloud computing Infrastructures to understand the security mechanism in the cloud.	**20**	**9**
	Total	**100**	**45**

Extra Reading for Self Learning:

Offerings of AWS,Pricing Model: Usage Reporting, billing and metering (AWS), Cloud Statistics , Six R for Cloud Migration,Cloud Security.

Course References:
I. **Reference Books**
1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd,
2. Cloud Computing: Automating the Virtualized Data Center
3. Cloud Computing by Dr. Kumar Saurabh, Wiley–India
4. Cloud computing: A practical approach by Anthony T. Velte, Tata McGraw-Hill
5. Cloud Computing Concepts, Technology & Architecture by Thomas Erl,
6.Zaigham Mahmood, and Ricardo Puttin
7. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola,
8. S.Thamarai Selvi - McGraw Hill Education (India) Private Limited,
9. Cloud Computing Web –Based Applications that change the way you
10.work and Collaborate Online by Michael Miller, Pearson
11. Cloud Computing for Dummies by Judith Hurwitz, Robin Bloor, Marcia
12. Kaufman, FernHalper

I. Websites

1. http://www.cloudcomputingpatterns.org/
2. http://whatiscloud.com
3. www.w3schools.com
4. www.Javatpoint.com
5. www.tutorialspoint.com

II. Other (Certification course/MOOC etc.)

1. Introduction to Cloud Computing on AWS for Beginners [2024] Learn Cloud Computing Concepts and AWS Basics | Master AWS Fundamentals and Hands-on Skills on Amazon Web Services (AWS)(Udemy)

2. Introduction to Cloud Computing with AWS, Azure understanding cloud computing concepts and introduction to Amazon Web Services, Microsoft Azure and Google Cloud. (Udemy)

3. Cloud Computing basics (Coursera platform)

4. Moving to the Cloud (Coursera Platform)

5. Service Management in Cloud Computing,Data Management in Cloud Computing,Resource Management in Cloud,Cloud Security,Open Source and Commercial Clouds, Cloud Simulator, Research trend in Cloud Computing(NPTEL)

Program: MCA (First Year)	Semester: III
Course Name: Practical based on Mobile Application Development, Machine Learning and Software Testing	Course Code: ITL31
Course Type: Practical (PR)	Credit Points: 3

Course Objectives:

1. To enable students to use flutter for mobile application development
2. To understand machine learning and deep learning algorithms

Course Outcomes with Blooms Level

Student will be able to

CO1: Develop mobile applications using flutter

CO2: Apply machine learning algorithms in practice and perform experiments using real-world Data

CO3:Demonstrate Test cases using Selenium testing tool

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2		2		2					
CO2	3	3	2		2		2					

Prerequisites

Python Programming, Object Oriented Programming concepts

Course Structure

Sr. No.	List of Practicals
1	**Mobile Application Development** 1.1 Assignments based on flutter widgets 1.2 Assignments based on state management 1.3 Assignments based on user interaction and navigation 1.4 Assignments based on Firebase and Sqlite 1.5 Assignments based on testing flutter app
2	**Machine Learning** 2.1 Assignments based on Numpy, Pandas, Matplotlib and Scikit-Learn libraries 2.2 Assignments based on Regression 2.3 Assignment based on Classification 2.4 Assignment based on Clustering 2.5 Assignment based on Deep Learning

3	**Software Testing** Assignment based on Selenium tool 3.1 Facebook sign up page 3.2 Frame Handling, mouse over operations (Login to an application) 3.3 Writing dynamic xpath (Gmail Account)

Program: MCA (Second Year)	**Semester: III**
Course Name: Mini Project (Research Project)	**Course Code: ITP31**
Course Type: Project Work (PROJ)	**Credit Points: 3**

Course Objectives:
1. To expose the students to use software engineering approach to analyze and formulate the real-world problem
2. To develop practical ability and knowledge about tools/techniques in order to solve the real world problems
3. To gain deeper understanding in specific domain areas
4. To inculcate the skills of team work
5. To gain the insight of technical writing

Course Outcomes with Blooms Level

Student will be able to

CO1: Create working project using tools and techniques learnt in this semester

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3				3					

Guidelines for Mini Project

1. Students are expected to develop a working project using tools and techniques learnt in this semester.
2. The student may take up the mini project in the second semester based on the courses learnt in that semester and for every next semester the mini project may be based on the courses learnt in the current semester along with all the subjects learnt in earlier semesters.
3. Students may develop mini project as a research project based on their interest in the domain.
4. Selected project/module must have relevant scope as per the marks assigned and as per the guidelines given by project coordinator
5. Internal guide should monitor and evaluate the progress of the project on an individual basis through handwritten workbook (Project Diary) maintained by students containing various project milestones with learnings and remarks from the internal guide for concurrent evaluation.
6. Students are expected to show a working demo of the project during final evaluation.
7. Students are expected to upload mini-project on GITHUB as project repositories of the institution.
8. Students are expected to submit the soft copy of the mini project report as a part of final submission.
9. A student should develop the SRS for the project.
10. A student is required to present the progress of the Mini Project work during the semester as per the schedule provided by the Project Coordinator.
11. Project reports duly signed by the Guide and HOD need to be submitted during examination.
12. Evaluation of mini projects shall be done for 75 marks.
13. Under this mini-project students are not restricted to software development projects only. There is flexibility to conduct any of the following work during that semester as a fulfillment of requirements of projects provided the student has done substantial work which can be justified.
    a) Industry Internship /Interdisciplinary Project
    b) Start-up Idea with Proof of Concept (POC)
    c) Paper Publication/Copyright
    d) Achievement in National/International Project competition/Hackathon/ Business Plan Competitions
    e) Any other activity fulfilling need and objectives of Mini Project with the prior permission of internal academic panel

Course References:

I.   Reference Books
    1. https://opac.library.iitb.ac.in/cgi-bin/koha/opac-detail.pl?biblionumber=128751

II. Websites

1. https://ieeexplore.ieee.org/document/720574

III. Other (Certification course/MOOC etc)

1. https://archive.nptel.ac.in/courses/106/105/106105182/

Program: MCA (Second Year)	Semester: III
Course Name: Value Added Course	Course Code: EC31
Course Type: Professional Elective Course(PEC)	Credit Points: 2

Value Added Courses (EC31)	
VAC	Blockchain
VAC	Devops(Maven, Docker)
VAC	Automation Testing Tool
VAC	Deep Learning
VAC	Salesforce

Program: MCA (Second Year)	Semester: III
Course Name: MOOC-III	Course Code: EC32

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Course Type: Professional Elective Course(PEC)	Credit Points: 1

Following is the suggestive list for MOOC-III elective courses on SWAYAM and NPTEL platform.

MOOC- III (EC32)	
PEC	IOT
PEC	Generative AI
PEC	Network Administration
PEC	NLP
PEC	Computer Vision (Image processing, classification and object detection)
PEC	Introduction to Quantum Computing
PEC	Progressive Web Applications
PEC	R programming
PEC	Multidisciplinary Course for holistic development

SEMESTER IV

Program: MCA (Second Year)	Semester: IV
Course Name: MOOC-IV	Course Code: EC41
Course Type: **Professional Elective Course (PEC)**	**Credit Points: 3**

Following is the suggestive list for MOOC-IV elective courses on SWAYAM and NPTEL platform.

MOOC- IV (EC41)	
1	Android Mobile Application Development
2	Android app using Kotlin
3	Arduino
4	Artificial Intelligence for Economics
5	Business Organisation and Management
6	E-Commerce
7	Introduction to Intellectual Property
8	Advanced Business Decision Support Systems

Program: MCA (Second Year)	Semester: IV

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Course Name: MOOC-V	Course Code: EC42
Course Type: Professional Elective Course (PEC)	Credit Points: 3

Following is the suggestive list for MOOC-V elective courses on SWAYAM and NPTEL platform.

MOOC- V (EC42)	
1	Scilab
2	Ruby
3	Advanced Algorithmic Trading and Portfolio Management
4	Advanced Corporate Strategy
5	Income Tax Law and Practice
6	LaTeX & XFig - typesetting software
7	Metaverse Spark AR
8	Big Data Computing

Program: MCA (Second Year)	Semester: IV
Course Name: Internship Project	Course Code: ITP41
Course Type: Project Work (PROJ)	Credit Points: 22

Course Objectives:

1. To expose the students to use software engineering approach to analyze and formulate the real-world problem
2. To develop practical ability and knowledge about tools/techniques in order to solve the real world problems
3. To gain deeper understanding in specific domain areas
4. To inculcate the skills of team work
5. To gain the insight of technical writing

Course Outcomes with Blooms Level

Student will be able to

CO1: Create working project using tools and techniques learnt in the programme (Create)

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3				3					

Guidelines for Project

1. Students are expected to develop a working project using tools and techniques learnt in this semester.
2. The student may take up the project in the second semester based on the courses learnt in that semester and for every next semester the mini project may be based on the courses learnt in the current semester along with all the subjects learnt in earlier semesters.
3. Selected projects/modules must have relevant scope as per the marks assigned and must be carried out in the Institute.
4. Internal guide should monitor and evaluate the progress of the project on an individual basis through handwritten workbooks (Project Diary) maintained by students containing various project milestones with learnings and remarks from the internal guide for concurrent evaluation.
5. Students are expected to show a working demo of the project during final evaluation.
6. Students are expected to upload mini-project on GITHUB as project repositories of the institution.
7. Students are expected to submit the soft copy of the project report as a part of final submission.
8. A student is required to present the progress of the project work during the semester as per the schedule provided by the Project Coordinator.

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INSTITUTE OF MANAGEMENT & CAREER COURSES (IMCC), PUNE (AUTONOMOUS)
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[CGPA-3.32] in Cycle 1

9. Project reports duly signed by the Guide and HOD need to be submitted during examination.
10. Evaluation of projects shall be done for 550 marks.
11. Students are expected to show a working demo of the project during final evaluation in semester IV.
12. The project report should be prepared as per the prescribed formats with all the chapters mentioned in project guidelines. And it should be printed on back-to-back pages (one copy) which should be signed by the internal guide and the Director of the Institute. A client (colleges, non-IT organization, and IT organization) certificate should be attached to prove the authenticity of the project work done.

Course References:

I.   **Reference Books**
   1.   https://opac.library.iitb.ac.in/cgi-bin/koha/opac-detail.pl?biblionumber=128751
II.   **Websites**
   1.   https://ieeexplore.ieee.org/document/720574

III.   **Other (Certification course/MOOC etc)**
   1.   https://archive.nptel.ac.in/courses/106/105/106105182/