

# MAHARISHI MARKANDESHWAR (DEEMED TO BE UNIVERSITY)

**MULLANA-AMBALA, HARYANA (INDIA), 133-207**

(Established under Section 3 of UGC Act, 1956)

(Accredited by NAAC with Grade A++)

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## Syllabus prior and post revision of the courses\*

\* Since all supporting documents for this metric exceeds the upload limit of 5Mb, we are providing samples as shown below. If required, we will provide all/any supporting documents.

| S.No. | Name of the Programme    | Pages |
|-------|--------------------------|-------|
| 1     | B.Tech Civil Engineering | 2-3   |
| 2     | B.Tech CSE               | 4     |
| 3     | BSc (Hons) Mathematics   | 5     |
| 4     | BCA                      | 6-13  |
| 5     | MCA                      | 14-30 |

# MAHARISHI MARKANDESHWAR ENGINEERING COLLEGE

An ISO 9001-2002 Certified Institute  
MULLANA - 133 207 (AMBALA)

## DEPARTMENT OF CIVIL ENGINEERING

Tel. No.: 01731-304164

E-mail: hod.civil@mmumullana.org

### Details of Revised Curricula / Syllabus of the Program (2022-23)

| S. No. | Name of the Institution | Programme Code | Name of the Programme    | Semester        | Name of the Subject as per syllabus (2021-22)                 | Name of the equivalent subject as per syllabus (2022-23) | Percentage revision in terms of deletion/addition/replacement |
|--------|-------------------------|----------------|--------------------------|-----------------|---------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------|
| 1      | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 3 <sup>rd</sup> | Introduction to Solid Mechanics                               | Strength of Material                                     | 30%                                                           |
| 2      | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 3 <sup>rd</sup> | Surveying & Geomatics                                         | Surveying & Geomatics                                    | 45%                                                           |
| 3      | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 3 <sup>rd</sup> | Concrete Technology                                           | Concrete Technology                                      | 75%                                                           |
| 4      | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 3 <sup>rd</sup> | Surveying & Geomatics Lab                                     | Surveying & Geomatics Lab                                | 33%                                                           |
| 5      | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 4 <sup>th</sup> | Environmental Engineering                                     | Environmental Engineering                                | 20%                                                           |
| 6      | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 5 <sup>th</sup> | Structural Analysis                                           | Structure Analysis                                       | 70%                                                           |
| 7      | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 5 <sup>th</sup> | Engineering Material for Sustainability                       | Engineering Material for Sustainability                  | 90%                                                           |
| 8      | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 5 <sup>th</sup> | Design of Concrete Structure-II                               | Advance RCC Design                                       | 30%                                                           |
| 9      | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 5 <sup>th</sup> | Construction Cost Analysis                                    | Construction Cost Analysis                               | 20%                                                           |
| 10     | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 5 <sup>th</sup> | Hydrology & Water Resource Engineering/Irrigation Engineering | Water resources & System engineering                     | 75%                                                           |
| 11     | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 6 <sup>th</sup> | Design of Steel Structure                                     | Design of Steel Structure                                | 5%                                                            |
| 12     | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 6 <sup>th</sup> | Traffic Engineering & management                              | Traffic Engineering & management                         | 30%                                                           |
| 13     | MMEC                    | 11UGR02        | B.Tech Civil Engineering | 6 <sup>th</sup> | Environmental Law & Policy                                    | Environmental Law & Policy                               | 100%                                                          |

Professor & Head  
Civil Engineering Department

M

# MAHARISHI MARKANDESHWAR ENGINEERING COLLEGE

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MULLANA - 133 207 (AMBALA)

## DEPARTMENT OF CIVIL ENGINEERING

Tel. No.: 01731-304164

E-mail: hod.civil@mmumullana.org

|    |      |         |                                |                                                                    |                                       |                                                        |      |
|----|------|---------|--------------------------------|--------------------------------------------------------------------|---------------------------------------|--------------------------------------------------------|------|
| 14 | MMEC | 11UGR02 | B.Tech<br>Civil<br>Engineering | 6 <sup>th</sup>                                                    | Rock Mechanics                        | Rock<br>Mechanics                                      | 36%  |
| 15 | MMEC | 11UGR02 | B.Tech<br>Civil<br>Engineering | 6 <sup>th</sup>                                                    | Ground<br>Improvement<br>techniques   | Ground<br>Improvement<br>techniques                    | 10%  |
| 16 | MMEC | 11UGR02 | B.Tech<br>Civil<br>Engineering | 3 <sup>rd</sup> ,4 <sup>th</sup> ,5 <sup>th</sup> ,6 <sup>th</sup> | -                                     | Prefatory<br>project                                   | 100% |
| 17 | MMEC | 11UGR02 | All Courses                    | 1 <sup>st</sup> ,2 <sup>nd</sup>                                   | Environmental<br>Studies              | Environmental<br>Education                             | 60%  |
| 17 | MMEC | 11PGR02 | M.Tech                         | 2 <sup>nd</sup>                                                    | Advanced<br>Foundation<br>Engineering | Advanced<br>Foundation<br>Engineering                  | 40%  |
| 18 | MMEC | 11PGR02 | M.Tech                         | 2 <sup>nd</sup>                                                    | -                                     | Advanced soil<br>mechanics                             | 100% |
| 19 | MMEC | 11PGR02 | M.Tech                         | 2 <sup>nd</sup>                                                    | -                                     | Soil Dynamics                                          | 100% |
| 20 | MMEC | 11PGR02 | M.Tech                         | 3 <sup>rd</sup>                                                    | -                                     | Earth<br>Retaining<br>Structure                        | 100% |
| 21 | MMEC | 11PGR02 | M.Tech                         | 3 <sup>rd</sup>                                                    | -                                     | Geotechnical<br>Aspect of<br>Earthquake<br>Engineering | 100% |
| 22 | MMEC | 11PGR02 | M.Tech                         | 3 <sup>rd</sup>                                                    | -                                     | Earth & Rock<br>fill dams and<br>slope stability       | 100% |
| 23 | MMEC | 11PGR02 | M.Tech                         | 3 <sup>rd</sup>                                                    | -                                     | Geotechnical<br>Lab                                    | 100% |
| 24 | MMEC | 11PGR02 | M.Tech                         | Elective                                                           | -                                     | Groundwater<br>contamination<br>and<br>remediation     | 100% |
| 25 | MMEC | 11PGR02 | M.Tech                         | Elective                                                           | -                                     | Geo<br>Environmental<br>engineering                    | 100% |
| 26 | MMEC | 11PGR02 | M.Tech                         | Elective                                                           | -                                     | Rock<br>Mechanics<br>Engineering                       | 100% |

Civil Engineering Department  
M. S. Engineering College  
MULLANA (Ambala)

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**DEPARTMENT OF CSE**

**Curriculum Update wef July, 2023 based on  
Stakeholder's feedback, BOS & External Experts**

| Sr. No. | Programme | Subject Code                                             | Subject Name                                | %age change                                         | Semester & Batch                             | Suggested By                |
|---------|-----------|----------------------------------------------------------|---------------------------------------------|-----------------------------------------------------|----------------------------------------------|-----------------------------|
| 1       | B.Tech    | BCSE-674                                                 | Openstack                                   | more than 20%                                       | 7 <sup>th</sup> CSE (CT&IS) & Batch: 2020-24 | Feedback & External Experts |
| 2       | B.Tech    | BCSE-675                                                 | Privacy & Security of Online Media Networks | more than 20%                                       | 7 <sup>th</sup> CSE (CT&IS) & Batch: 2020-24 | Feedback                    |
| 3       | B.Tech    | BCSE-634                                                 | Information Security & IPR                  | more than 20%                                       | 7 <sup>th</sup> CSE (CT&IS) & Batch: 2020-24 | Feedback & External Experts |
| 4       | B.Tech    | BCSE-514                                                 | Big Data & Analytics                        | Only Course Objective & Outcomes with minor changes | 5 <sup>th</sup> CSE & Batch: 2021-25         | Board of members            |
| 5       | B.Tech    | BCSE-                                                    | Virtualization & Scheduling                 | more than 20%                                       | 5 <sup>th</sup> CSE (CT&IS) & Batch: 2021-25 | Feedback & Board of members |
| 6       | B.Tech    | Full scheme: 1 <sup>st</sup> to 8 <sup>th</sup> semester | New Specialization: AI & Machine Learning   | 3 <sup>rd</sup> to 8 <sup>th</sup> semesters        | 2023-27                                      | AICTE guidelines & Feedback |

  
HoD

Head  
Department of Computer  
Science & Engineering  
133207

| Name of the Institution | Programme Code | Name of the Programme   | Semester | Name of the Subject as per Syllabus 2021-22                      | Name of equivalent Subject as per Syllabus 2022-2023 | Percentage Revision in terms of deletion/ addition/ replacement |     |
|-------------------------|----------------|-------------------------|----------|------------------------------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------|-----|
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      | New Scheme.<br>Introduced from the session 2022-23 as per NEP-20 | Calculus                                             | 100                                                             |     |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      |                                                                  | Calculus Lab                                         | 100                                                             |     |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      |                                                                  |                                                      | Algebra                                                         | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      |                                                                  |                                                      | Group Theory-I                                                  | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      |                                                                  |                                                      | Hindi                                                           | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      |                                                                  |                                                      | Essence of Indian Traditional Knowledge                         | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      |                                                                  |                                                      | Introduction to computer language R                             | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      |                                                                  |                                                      | Introduction to computer language R (Lab)                       | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      |                                                                  |                                                      | Basic Operation Research                                        | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      |                                                                  |                                                      | Web Designing using HTML                                        | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 1st      |                                                                  |                                                      | Differential Equations                                          | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 2nd      |                                                                  |                                                      | Differential Equations (Lab)                                    | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 2nd      |                                                                  |                                                      | Analytical Geometry                                             | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 2nd      |                                                                  |                                                      | Real Analysis                                                   | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 2nd      |                                                                  |                                                      | English                                                         | 100 |
| MMEG                    | 11UGR55        | B.Sc (Hons) Mathematics | 2nd      |                                                                  |                                                      | English (Lab)                                                   | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 2nd      |                                                                  |                                                      | Probability & Statistics                                        | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 2nd      |                                                                  |                                                      | Mathematical Finance                                            | 100 |
| MMEC                    | 11UGR55        | B.Sc (Hons) Mathematics | 2nd      |                                                                  |                                                      | Database Management Systems                                     | 100 |

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Department of Mathematics  
M.M. Engineering College  
Mullana-Airbala

**DETAILS OF REVISION IN BCA-2<sup>nd</sup> YEAR SYLLABUS FOR BATCH 2022-25**

| Detailed Syllabus<br>(Prior to revision)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Detailed Syllabus<br>(Post revision)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | % age<br>of<br>change |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <b>BCA-301: Database Management System</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |
| <p style="text-align: center;"><b><u>Section – A</u></b></p> <p><b>Basic Concepts:</b> Data vs. Information, Database, Database Management System, Conventional File Processing Vs DBMS, Characteristics of the Database, Data Models, Schema, Subschema, Three schema architecture of DBMS, instances, Physical and logical Data independence, Database Languages, Database administrator, Database users.</p> <p style="text-align: center;"><b><u>Section – B</u></b></p> <p><b>The Entity-Relationship Model:</b> Entity, Entity Set, notations used for ER Diagram, Design issues, Attributes and Keys, Strong and Weak Entity Sets, Entity-relationship diagram, Extended E-R features: Generalization, Specialization and Aggregation, Mapping Constraints.</p> <p><b>Relational Model:</b> Concepts, Languages, Structure of relational databases, Integrity Constraints: Primary key, Not null, Unique, Check, Referential key. Functional Dependencies: Full and partial, Normalization: Different anomalies in designing a database, 1NF, 2NF, 3NF &amp; BCNF, 4NF, 5NF.</p> <p style="text-align: center;"><b><u>Section – C</u></b></p> <p><b>Relational Algebra:</b> Basic operations, selection and projection, set theory operations: union, intersection, set difference and division, Join operations, Relational Calculus, Introduction to views, updates on views.</p> <p><b>SQL:</b> Introduction, Types of SQL Commands, Writing Queries in SQL, aggregate functions, Nested Queries, Null values and Embedded SQL, Dynamic SQL.</p> <p style="text-align: center;"><b><u>Section – D</u></b></p> <p><b>Transaction Management:</b> Transaction Concept and State, ACID</p> | <p style="text-align: center;"><b><u>Section – A</u></b></p> <p><b>Basic Concepts:</b> Introduction of Data base management system, Need of DBMS, Characteristics of data modeling and Database, Data storage and retrieval, Concurrency control, Data integrity and security, Database languages, Data vs. Information, Database, Conventional File Processing Vs DBMS, Data Models, Schema &amp; Instances, Subschema.</p> <p><b>Data Abstractions &amp; Data Independence:</b> Introduction of 3-Tier Architecture, Three Schema Architecture of DBMS: Physical level, Conceptual level, External level, Physical and logical Data independence, Database administrator, Database users.</p> <p style="text-align: center;"><b><u>Section – B</u></b></p> <p><b>The Entity-Relationship Model:</b> Entity, Entity Set, notations used for ER Diagram, Design issues, Attributes and Keys, Strong and Weak Entity Sets, Entity-relationship diagram, Minimization of ER diagram, Recursive Relationships, Impedance Mismatch, Generalization, Specialization and Aggregation.</p> <p><b>Relational Model:</b> Structure of Relational Database, Keys in Relational Model: Candidate, Super, Primary, Alternate and Foreign, Mapping from ER model to Relational model, Integrity Constraints, Functional Dependencies.</p> <p><b>Normalization:</b> Full and partial, Normalization: Different anomalies in designing a database, 1NF, 2NF, 3NF &amp; BCNF, 4NF, 5NF.</p> <p style="text-align: center;"><b><u>Section – C</u></b></p> | 20%                   |

properties, Overview of serializability, serializable and non-serializable transactions. Problems with Transaction Management.  
**Concurrency Control:** Concurrency, lost update, dirty read incorrect summary problems due to concurrency, Concurrency control techniques: Overview of 2-Phase Locking Protocols, Timestamp-based Protocols and Deadlock Handling.  
**Database recovery:** Failure Classification, Log-based Recovery and Shadow Paging.

**Relational Algebra:** Introduction, Basic operators, Extended operators, Inner join vs. Outer join, Join Operation vs. Nested Query, Tuple Relational Calculus.  
**SQL:** Introduction, Types of SQL Commands, Writing Queries in SQL, aggregate functions, Nested Queries, Null values and Embedded SQL, Dynamic SQL.

**Section – D**

**Transaction Management:** Transaction Concept and State, Steps for ATM Transactions, ACID properties, Overview of serializability, Serializable and non-serializable transactions.  
**Concurrency Control:** Introduction to Concurrency, Concurrency problems: Dirty read, Incorrect summary, Lost update, Concurrency control techniques, Timestamp-based Protocols and Deadlock Handling.  
**Database recovery:** Database Recovery Technique, Backward recovery, Forward recovery, Log based recovery.

**Benchmark:**

1. University of Mumbai
2. Delhi university
3. Amity university, Noida
4. National Institute of Technology, Trichy
5. Kurukshetra university, Kurukshetra

**BCA-302: Web Designing Fundamentals**

**Section – A**

**Fundamentals of Web designing:** Basics of Internet, World Wide Web, Web page, Home page, Static, Dynamic and Active web page, Website, Steps for Developing Website: Choosing the Contents, Planning and Designing Web Site, Creating a Website, Searching and Web-Casting Techniques, Web Hosting and Hosting Sites.  
**Client Side Scripting Languages:** Java Script, Active X control and Plug-ins; Web Server Architecture, Image maps, CGI, API web database connectivity - DBC, ODBC.

**Section – B**

**HTML5:** Introduction, Essential Tags & its Attributes, Text Styles, Text Effects, Exposure to Various Tags: DIV, MARQUEE, HR, Comment,

**Section – A**

**Fundamentals of Web designing:** Basics of Internet, World Wide Web, Web page, Web Browser, Web Server, Proxy Server, Static and Dynamic web page, Website Development: Website overview, Website types, Website designing, Development, Publishing, Hosting, Website URL registration.  
**Client Side Scripting Languages:** Java Script, Active X control and Plug-ins, Web Server Architecture, Image maps, CGI, API web database connectivity: DBC, ODBC.

**Section – B**

**HTML5:** Introduction, Basic Tags, Elements, Attributes,

IMG; Color and Background of Web Pages, Lists and their Types, Attributes of Image Tag, Hypertext, Hyperlink and Hypermedia, Anchors and URLs, Links to External Documents, Different Section of a Page and Graphics, Footnote and E-mailing, Creating Table, Frame and Forms.

### Section – C

**CSS:** Basic Concepts, Properties, Creating Style Sheets, Common Tasks with CSS: Text, Fonts, Margins, Links, Colors, Marquee, Mouseovers, Filters and Transitions, Forms, Image and Sound, Working with block elements and objects: Lists and Tables, CSS Id and Class, Box Model, Use of CSS in HTML Documents, Linking and Embedding of CSS in HTML Document.

**Java script:** Overview of Java Script, Client side Java Script, Capturing user input, Data types, Literals, Variables, Arrays, Operators, Data declaration, Expressions, Constructs, Assignment, Control Statements, Function call, Return, With, Delete, Method invocation.

### Section-D

**JQuery:** Introduction of jQuery, Syntax, Selector, Events and effects.

**DHTML:** Introduction, Features, Events, Dynamic Positioning, Layer Object, Properties of STYLE, Dynamic Styles, Event Handlers.

**XML:** Introduction, Features, XML Support and Usage, Structure of XML Documents, Structures in XML, Valid Documents, Ways to use XML, XML for Data Files, Embedding XML into HTML documents.

Formatting, Phase tags, Meta tags, Images, Tables, List, Text links, Text Styles, Text Effects, Image links, Frames, I frames, Blocks, Background, Colors, Fonts, Embed multimedia, Marquees.

**HTML Forms:** Form Tag, Attributes of Form, Form Elements, Input Type, Input Attributes, POST and GET Method, Creating a Live Website Form, HTML Validators

### Section – C

**CSS:** Introduction, Syntax, Inclusion, Measurement Units, Colors, Backgrounds, Fonts, Text, Images, Links, Tables, Borders, Margins, List, Padding, Cursors, Outlines, Dimensions, Scrollbars

**CSS Advanced:** CSS visibility, Positioning, Layers, Pseudo Classes, Pseudo Elements, Text effects, Media Types, Printing, Layout, Validations, CSS Id and Class, Box Model, 2D Transform, 3D Transform, Animation, Box Sizing, Responsive Web Design with Bootstrap: Introduction to Bootstrap, Installation of Bootstrap, Grid System.

### Section-D

**JavaScript:** Introduction to JavaScript, JavaScript Types, Literals, Variables, Data Types, Operators in Conditions Statements, Loops, Switch, Functions JS Popup Boxes, Events, Arrays, Working with Arrays, Objects, Functions, String, Validation of Forms.

**Document Object Model:** Introduction to DOM, DOM Method, DOM Document, CSS, Animation, DOM Events, Event Listener.

**JS Browser Object Model:** JS Window, Screen, Location, History, Navigator, Pop up alert, Cookies.

40%

### **Benchmark:**

1. Indian Institute of Technology, Kharagpur
2. MLR Institute of Technology College in Hyderabad, Telangana
3. Jawaharlal Nehru Technological University, Kakinada



### Section - A

**Overview:** Features, History and Version of python, Application of Python, Environment, The Basic Elements, Installation Steps, Python Data Types, Variables, Keywords, Identifiers, Literals, Operators, Single line comments, Multiline comments.

**Control Structure:** If statements, Loops, Break and Continue statements, Pass, Python number, String, Built in Number Functions, Built in String Functions.

### Section-B

**Overview of Python Collections:** **List:** Fundamental List Operations, Accessing, Updating, Deleting, Indexing, Slicing and Built-in list methods in Python; **Tuples:** Basic tuples Operations, Accessing, Inserting, Deleting, Updating elements, Built-in tuple Functions & Methods. **Dictionary:** Properties of Dictionary Keys, Basic operations on Dictionary, Built-in Dictionary Functions & Methods.

### Section- C

**Introduction to Numpy:** ndarray object, Datatype, Array attribute, Indexing and slicing, Array manipulation, Mathematical function, Arithmetic operation, Statistical functions.

**Date, Time, Function and Modules:** Date and Time function, Calendar Module, Defining and Calling a Function, Function Arguments, Required Arguments, Keyword Arguments, Default Arguments, Variable Length Arguments, Anonymous Functions, Scope of Variables, Class importing modules.

**Overview of Object and Classes:** Creating objects and classes and instance. Accessing attributes, garbage collection, Class Inheritance, Overriding methods.

### Section- D

**Exceptions Handling:** Standard Exceptions, Assertions in Python.

### Section - A

**Overview:** Features, History and Version of Python, Applications of Python, Installation Steps, Input/output operations, Data Types, Variables, Keywords, Identifiers, Literals, Operators, Single line comments, Multiline comments, Type Conversions.

**Control Structure:** If statements, Loops, Break and Continue statements, Pass.

**Strings:** String Manipulation, Basic operations, Slicing, Built in String Functions.

### Section-B

**Overview of Python Collections:** **List:** Fundamental List Operations, Accessing, Updating, Deleting, Indexing, Slicing and Built-in list methods in Python.

**Tuples:** Basic tuples Operations, Accessing, Inserting, Deleting, Updating elements, Built-in tuple Functions & Methods.

**Dictionary:** Properties of Dictionary Keys, Basic operations on Dictionary, Built-in Dictionary Functions & Methods.

### Section- C

**Introduction to Numpy:** ndarray object, Datatype, Array attribute, Array Creation Routines, Indexing and slicing, Array manipulation, Mathematical function, Arithmetic operations.

**Function:** Defining and Calling a Function, Function Arguments, Required Arguments, Keyword Arguments, Default Arguments, Variable Length Arguments, Scope of Variables, Lambda Function.

**Module:** Introduction to modules, Importing module.

**Overview of Object & Classes:** Creating class and object, Accessing attributes, Constructors in Python, Class Inheritance, Overriding methods.

### Section- D

**Exceptions Handling:** Standard Exceptions, Difference between syntax error and exception, Exception handling, try

15%

Handling an Exception, The try finally Clause, raising an exception User-Defined Exceptions.

**Database Access:** Create, Insert, Delete and update data into database using MYSQL or SQLite database. **File Input/output:** Creating files, reading and writing data using files. Overview of GUI Programming(Tkinter).

finally Clause, Raising an exception, User-Defined Exceptions.

**Database Access:** Connecting to a database, Creating tables, Insert, Delete and update data into database using MySQL database.

**File Input/output:** Creating files, File opening in various modes, reading and writing data using files.

**GUI Programming:** Tkinter introduction, Tkinter widgets.

**Benchmark:**

1. Indian Institute of Technology, Kanpur
2. Kurukshetra University, Kurukshetra

**BCA-403: Operating System**

**Section- A**

**Introductory Concepts:** Operating system functions and characteristics, historical evolution of operating systems, Classification: Real time systems, Time Sharing, Network Systems, Distributed systems, Batch Processing, Multitasking, Multiprogramming, Multiprocessing

**Section- B**

**Process management:** Process concepts, Process states and Process Control Block.

**CPU Scheduling:** Scheduling criteria, Levels of Scheduling, Scheduling algorithms, Multiple processor scheduling.

**Deadlocks:** Deadlock characterization, Deadlock prevention and avoidance, Deadlock detection and recovery, practical considerations.

**Section- C**

**Concurrent Processes:** Critical section problem, Semaphores, Classical process co-ordination problems and their solutions, Inter-process Communications.

**Memory Management:** Logical versus Physical address space, Swapping, Contiguous Memory Allocation, Partition, Paging and Segmentation.

**Virtual memory concepts:** Demand Paging, Page replacement Algorithms, Thrashing.

**Section- D**

**Section- A**

**Introductory Concepts:** Historical evolution of operating systems, Operating system functions and characteristics, Classification: Real time systems, Time Sharing, Network Systems, Distributed systems, Batch Processing, Multitasking, Multiprogramming, Multiprocessing, System call, Basic Thread mechanics, Kernel Vs User level threads, Multithreading models.

**Section- B**

**Process management:** Process concepts, Process states and Process Control Block, Context Switching, CPU Scheduler, Time quantum, CPU Bound, I/O bound.

**CPU Scheduling:** Scheduling criteria, Levels of Scheduling, Scheduling algorithms: Pre-emptive and Non Pre-emptive Scheduling Algorithm Multiple processor scheduling.

**Deadlocks:** Deadlock characterization, Deadlock prevention and avoidance, Deadlock detection and recovery, practical considerations.

**Section- C**

**Concurrent Processes:** Critical section problem, Semaphores, Classical process co-ordination problems & their solutions, Inter-process Communications, Reader writer problem, producer-consumer problem.

**Memory Management:** Logical versus Physical address

25%

**Device management:** Disk scheduling, Disk structure, Disk management  
**File Systems:** File support access methods, allocations methods, contiguous, linked and indexed allocation, Directory system: single level, tree structures, acyclic graph and general graph directories, file protection.

space, Swapping, Fragmentation, Contiguous Memory Allocation, Partition, Paging and Segmentation.  
**Virtual memory concepts:** Demand Paging, Page Fault, Page hit-miss Ratio, Page replacement Algorithms, Thrashing, Memory Access time.

**Section- D**

**Device management:** Disk scheduling, Disk structure, Disk management.  
**File Systems:** File support access methods, Allocations methods, Contiguous, Linked and indexed allocation, Directory system: single level, tree structures, acyclic graph and general graph directories, Security and Protection Mechanisms.

**Benchmark:** Kurukshetra University, Kurukshetra

**BCA-404: Software Engineering**

**Section- A**

**Introduction to Software Engineering:** Introduction, Goals and Principles, Software crisis, Phase development of SDLC, Software development process models with comparison: Waterfall, Incremental, Spiral, Evolutionary, Prototyping, Rapid prototyping, Time boxing, V Shaped Models.

**Section- B**

**Planning the Software Project:** Cost estimation: COCOMO model, Risk management, project scheduling, personnel planning, team structure, Staffing, Software configuration management, quality assurance, project monitoring.

**Software Requirement Analysis and Specification:** Functional and non-functional, feasibility studies, requirements elicitation, Process modeling with physical and logical DFDs, Entity Relationship Diagram, Data Dictionary, Requirement validation, Requirement specification: Software requirement Specification (SRS).

**Section- C**

**Design Concepts and Principles:** Design process and concepts, software architecture, data design, user interface design.

**Section- A**

**Introduction:** Introduction to Software & Software Engineering, Goals and Principles, Myths, Importance of Software Engineering, Software Development Life Cycle, Software Process and its standard, Work product.  
**Software process model:** Waterfall model, Iterative enhancement model, Prototyping model, Spiral model, Time boxing, V Shaped Models RAD model, 4th Generation model, Formal methods, Agile development.

**Section- B**

**Requirement Engineering:** Software Requirements, Types of Requirements, Requirement Engineering Cycle, Characteristics of Requirements, Requirement verification and validation.

**Planning the Software Project:** Cost estimation: COCOMO model, Risk management, Project scheduling, Personnel planning, Team structure, Staffing, Software configuration management, Project monitoring.

**Software Requirement Analysis & Specification:**

40%

**Design Fundamentals:** Principles of modularization, structured design methodologies, coupling and cohesion, high level and detailed design.  
**Coding:** Coding Programming languages and development tools, Good programming practices, Coding Standards.

#### Section- D

**Testing and Implementation:** Objectives of software testing, levels, test cases, types of s/w testing, black box and white box testing, Cyclomatic complexity, alpha, beta testing, boundary conditions, regression testing, structural testing, unit testing, integration testing, validation testing, system testing and debugging.

**Maintenance:** Introduction, Types of Maintenance.

Functional and non-functional, Feasibility studies, Requirements elicitation, Process modeling with physical and logical DFDs, Entity Relationship Diagram, Data Dictionary, Requirement specification: Software requirement Specification (SRS).

#### Section- C

**Design fundamental:** Process, Data and Behavioral modeling, Design Concepts, Modularity, Architectural design, Coupling and Cohesion.

**Design Approaches:** Top-down and bottom-up design, Object-oriented Analysis, Function oriented and Object-Oriented Design approach, Software Design Document.

**Coding:** Coding Programming languages and development tools, Coding principles and standard, Good programming practices, Coding styles and documentation.

#### Section- D

**Testing and Implementation:** Testing and Software Quality Testing principles, Testing strategies, Black-box and White-box Testing Techniques, Levels of testing-unit, integration, system, regression, Test Plan, Test Cases Specification, Software debugging.

**Software Maintenance:** Software Quality Assurance (SQA), SQA tasks, Software amplification and removal, Formal Technical Reviews, Software Quality Factors: ISO 9126, SEI CMM, CMML, Software Reliability, Software Availability)

#### **Benchmark:**

1. Bennett University
2. Delhi University

**The above revision/change has been approved by the following academic bodies:**

1. Board of Studies vide resolution no. 03 dated 17/07/2023
2. Academic Council vide resolution no. 14 dated 17/11/2023

  
PRINCIPAL

14. The weightage of continuous assessment (internal marks) and summative assessment (end semester examination) for Theory and Practical courses of BCA/MCA online programme would be 30 and 70 respectively.

The meeting ended with a vote of thanks.



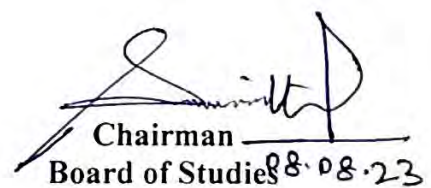
**-Sd-  
Chairman  
Board of Studies**

Endst. No. MMICTBM/BOS/2023/ 133

Dated: 08.08.2023

**A copy of the above is forwarded to the following for information & necessary action:**

1. Controller of Examinations, MM(DU)
2. Dean, Faculty of Engineering & Technology, MM(DU)
3. Dean, Academic (Technical), MM(DU)
4. Concerned Members, MMICTBM, MM(DU)
5. Deputy Registrar (Academic), MM(DU)
6. Dr. Sonal Chawla, Professor,  
Dept. of Computer Science & Applications, Punjab University, Chandigarh
7. Mr. Mukesh Gupta, Sr. Manager,  
Mahindra & Mahindra Ltd., Mohali



**Chairman**  
**Board of Studies** 08.08.23

DETAILS OF REVISION IN MCA-2<sup>nd</sup> YEAR SYLLABUS FOR BATCH 2022-24

| Detailed Syllabus<br>(Prior to revision)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Detailed Syllabus<br>(Post revision)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | % age<br>revision |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <b>MCA-301: Programming with Python</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |
| <p style="text-align: center;"><u>Section – A</u></p> <p><b>Basic of Python:</b> Features, History and Version of Python, Application of Python, The basic elements of Python, Installation steps of Python, Variables, Keywords, Identifiers, Literals, Operators, Comments, Decision making, Branching programs, Control structures, Loops, Break and Continue statements, Numbers.<br/> <b>String:</b> Creating, Indexing, Slicing, Manipulation.</p> <p style="text-align: center;"><u>Section – B</u></p> <p><b>Array:</b> Introduction to Array module, Advantage, Indexing, Slicing and processing the array. <b>Python Lists:</b> Accessing, Updating, Delete, Basic List Operations, Indexing, Slicing and matrixes, Built-in list Functions &amp; Methods.<br/> <b>Python Tuples:</b> Accessing, Updating, Deleting, Basic tuples Operations, Indexing, Slicing and Matrixes, Built-in tuple Functions &amp; Methods, No Enclosing Delimiters.<br/> <b>Python Dictionary:</b> Accessing, Updating, Deleting, Properties of Dictionary Keys; Built-in Dictionary Functions &amp; Methods.</p> <p style="text-align: center;"><u>Section – C</u></p> <p><b>Date and Time:</b> Time tuple, Time module, Calendar module.<br/> <b>Python Function:</b> Function vs. Method, Defining and Calling function, Anonymous function. Module.<br/> <b>Introduction to OOPS:</b> Object, Class, Attribute, Garbage Collection, Class Inheritance, Overriding Methods, Base Overloading Methods, Overloading Operators, Data Hiding.<br/> <b>Exceptions Handling:</b> Standard Exceptions, Assertions in Python, Handling an Exception, The try finally Clause, User-Defined Exceptions.<br/> <b>File Handling:</b> Types of file, Creating, Open, Close, Read and Write in files.</p> | <p style="text-align: center;"><u>Section – A</u></p> <p><b>Basic of Python:</b> Introduction, Features, History and Version of Python, Application of Python, Installation steps of Python, Python IDLE and IDE, The basic elements of Python, Comments, Datatypes in Python (built-in, sequence, sets, user-defined datatypes), Variables, Keywords, Identifiers, Literals, Operators, how to Input and output, commandLine argument, Decision making, Branching programs, Control structures, Loops, Break and Continue statements, Numbers.<br/> <b>Array:</b> Introduction to Array module, Advantage, Indexing, Slicing, and processing the array.</p> <p style="text-align: center;"><u>Section – B</u></p> <p><b>String:</b> Creating, Indexing, Slicing, comparing Manipulation.<br/> <b>Functions:</b> function vs method, defining a function, calling a function, returning value from function, types of Function arguments, Anonymous function.</p> <p><b>Python Lists:</b> Accessing, Updating, Deleting, Basic List Operations, Indexing, Slicing and Matrixes, Built-in List Functions &amp; Methods.<br/> <b>Python Tuples:</b> Accessing, Updating, Deleting, Basic tuples Operations, Indexing, Slicing and Matrixes, Built-in tuple Functions &amp; Methods, No Enclosing Delimiters.<br/> <b>Python Dictionary:</b> Accessing, Updating, Deleting, Properties of Dictionary Keys, Built-in Dictionary Functions &amp; Methods.</p> <p style="text-align: center;"><u>Section – C</u></p> <p><b>Introduction to OOPS:</b> Class, Constructor, Object, Encapsulation, Abstraction, Attribute, Garbage Collection, Class Inheritance, Overriding Methods, Base Overloading Methods, Overloading Operators, Data Hiding. Creating a module.<br/> <b>Exceptions Handling:</b> Error and exception in python Standard Exceptions, Handling an Exception, The Except Block, the Assert</p> | 20%               |

Replace, Regular Expression Patterns.

**Section – D**

**Database Connectivity:** MYSQL Database Access, Create, Insert, Delete and update data into database, Commit and Rollback operation in database.

**GUI Programming:** Overview of various Python GUI development tools, Introduction of tkinter, Tkinter Widgets.

**Overview of Django Framework:** Introduction to Django framework, features, Django webserver, Django architecture, Creating a project, Django App life cycle.

statement, The try finally Clause, User-Defined Exceptions.  
**File Handling:** Types of file, Creating, Open, Close, Read and Write in files. Working with text and binary files, pickle in python, the Seek() and tell() method.

**Data Structures in python:** Linked Lists, Stacks, Queues, Deques

**Section – D**

**Date and Time:** Time tuple, Time module, Calendar module.

**Threads:** process vs thread, uses of threading, creating threads, thread class methods,

**Database Connectivity:** Database connectivity with MySQL and SQLite, MySQLdb Module, Create, Insert, Delete and update data into database, Commit and Rollback operation in database.

**GUI Programming:** Overview of various Python GUI development tools, Introduction of Tkinter, Tkinter Widgets.

**Overview of Data Science using Python:** Data Frame, creating data frame from excel spreadsheet, .csv file, list, tuple and dictionary. Operations on data frame, data visualization: bar graph, histogram, pie chart, line graph.

**MCA-302: Cloud Computing**

**Section – A**

**Cloud Computing Overview:** Origin of Cloud computing, Cloud components, Essential characteristics: On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service, Advantages and challenges of Cloud computing, Comparing traditional computing with cloud computing.

**Virtualization:** Basics of virtualization, Virtualization technologies, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing. Business cases for the need of Cloud computing environment.

**Section – B**

**Cloud Architecture Layers and Models:** Layers in cloud architecture, Software as a Service (SaaS), Features and its benefits, Platform as a Service (PaaS), Features and its benefits, Infrastructure as a Service (IaaS), Features and its benefits,

**Section – A**

**Introduction and Evolution of Computing Paradigms:** Brief History and Evolution – History of cloud computing, evolution of cloud computing, traditional vs cloud computing, Cloud Computing Characteristics. Advantages and challenges of Cloud computing

**Virtualization:** Basics of virtualization, Virtualization technologies, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing. Business cases for the need of Cloud computing environment

**Section – B**

**Cloud Architecture Layers and Models:** Layers in cloud architecture, Software as a Service (SaaS), Features and its benefits, Platform as a Service (PaaS), Features and its benefits, Infrastructure as a Service (IaaS), Features and its benefits, Service providers. Cloud deployment models: Public clouds, Private clouds, Community clouds, Hybrid clouds,

30%

service providers. Cloud deployment models: Public clouds, Private clouds, Community clouds, Hybrid clouds, Comparison of Cloud Deployment Models.

**Cloud Computing Platforms:** Amazon Web Services, Cloud-Snowflake, Windows Azure platform, A Comparison of Cloud Computing Platforms.

Section – C

**Cloud Security Concerns:** Security concerns in Traditional IT, Challenges in terms of Application Security, Server Security and Network Security. Security Reference Model, Abuse and Nefarious Use of Cloud Computing, Insecure Interfaces and APIs, Malicious Insiders, Shared Technology Issues, Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile, Introduction to the different vendors offering/services for Security in public and private cloud.

Section – D

**Multi-cloud management:** Challenges in managing heterogeneous clouds, Benefits and advantages of multi-cloud management systems, Implementing multi-cloud management system. Cloud Computing in Business, Various Biz Clouds focused on industry domains (Retail, Banking and Financial sector, Life Sciences, Social networking, Telecom, Education). Introduction to Cloud Enablers (Business Intelligence on cloud, Big Data Analytics on Cloud).

**Future Research:** Current issues in cloud computing leading to future research directions.

Comparison of Cloud Deployment Models.  
**Introduction to cloud Implementation on various platforms:** Amazon Web Services, The Elastic Compute Cloud (EC2). The Simple Storage Service (S3), The Simple Queuing Services (SQS), Google AppEngine - PaaS, Windows Azure; Aneka, Hadoop, A Comparison of Cloud Computing Platforms.

Section – C

**Cloud Security Concerns:** Security concerns in Traditional IT, Challenges in terms of Application Security, Server Security and Network Security. Security Reference Model, Abuse and Nefarious Use of Cloud Computing, Insecure Interfaces and APIs, Malicious Insiders, Shared Technology Issues, Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile, Introduction to the different vendors offering/services for Security in public and private cloud.

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**Future Research:** Current issues in cloud computing leading to future research directions.

**MCA-304(a): Advanced Java Programming**

Section – A

**Introduction to J2EE:** J2EE Architecture, J2EE Technologies, Types of servers in J2EE Application, Developing J2EE Applications, Business tier using POJO (Plain Old Java Objects), Role of J2EE in Enterprise applications.

Section – A

**Introduction to J2EE:** J2EE Architecture, J2EE Technologies, Types of servers in J2EE Application, Developing J2EE Applications, Business tier using POJO (Plain Old Java Objects), Role of J2EE in Enterprise applications.

10%



**Database Programming with JDBC:** JDBC Architecture, Database Drivers, JDBC packages, Database Connection, Statement Objects, Result Set, Transaction Processing, SQL Exception, Prepared Statement, Steps to create JDBC application, JDBC advantages and disadvantages.

### Section – B

**Network Programming:** Client-Server communication, Host Identification and service ports, Introduction of Socket, Types of Socket, Socket API, Java.NET classes and Interfaces, TCP/IP Socket Programming and UDP Socket Programming, Reading and Writing data via URL Connection.

**Java Beans:** Definition, advantages of Java Beans, Java Beans API, Introspector, Property Descriptor, eventSet Descriptor and Method Descriptor.

### Section – C

**Java Servlets API:** HTTP protocol, Life cycle of a Servlet, steps to create Servlet, Servlet API, Servlet Interface, Servlet Configuration, Servlet Exceptions, HTTP Servlet, Generic Servlet Request and responses, Session Tracking, Servlet Context, Servlet Collaboration.

**Filters & Frameworks:** Introduction to Filter, Filter API, Manipulating Responses using Filter API, Authentication Filter, Deployment Descriptor for Filters, Frameworks overview: Struts, Spring and Hibernate.

### Section – D

**Remote Method Invocation (RMI):** RMI, Object Serialization, RMI layer model, Skelton, Stub.

**React JS:** React JS basics, Setup, Components, State, Constructor, Life cycle, Forms, Tables, Front end and back end integration, creating applications in React JS.

**Enterprise Java Beans:** EJBs, EJB Container and its services, Working with EJBs, Types of EJB.

**Database Programming with JDBC:** JDBC Architecture, Database Drivers, JDBC packages, Database Connection, Statement Objects, Result Set, Transaction Processing, SQL Exception, Prepared Statement, Steps to create JDBC application, Transaction management and connection pooling.

### Section – B

**Network Programming:** Client-Server communication, Host Identification and service ports, Introduction of Socket, Types of Socket, Socket API, Java.NET classes and Interfaces, TCP/IP Socket Programming and UDP Socket Programming, Reading and Writing data via URL Connection.

**Remote Method Invocation (RMI):** RMI, Object Serialization, RMI layer model, Skelton, Stub.

### Section – C

**Java Beans and Design patterns:** Java Beans API, Introspector, Property Descriptor, Overview of design patterns ad their importance, implementing design patterns in java, applying design patterns to solve real world problems.

**Java Servlets API:** HTTP protocol, Life cycle of a Servlet, steps to create Servlet, Servlet API, Servlet Interface, Servlet Configuration, Servlet Exceptions, HTTP Servlet, Generic Servlet Request and responses, Session Tracking, Servlet Context, Servlet Collaboration.

### Section – D

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**React JS:** React JS basics, Setup, Components, State, Constructor, Life cycle, Forms, Tables, Front end and back end integration, creating applications in React JS.

**Enterprise Java Beans:** EJBs, EJB Container and its services, Working with EJBs, Types of EJB.

### Section – A

**Introduction:** Android OS design and Features, Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android vs iOS, Importance of mobile strategies in business world, Mobile Apps-Benefits, Challenges.

**Getting Started with Mobility:** Mobile platforms, Development environments, Mobile OS, Architectures of Android, Setting up the Mobile Apps Development Environment along with an emulators, Screen Orientation.

### Section – B

**Designing App User Interface (UI):** Mobile UI resources: Layout, UI elements, Draw-able, Menu, UI Elements and Events, Activity-states and life cycle, Interaction among activity.

**UI Widgets:** Working with Button, Toast, Custom Toast, Toggle Button, Switch Button, Image Button, Check Box, Alert Dialog, Spinner, Auto Complete Text View, Rating Bar, Date Picker, Time Picker, Progress Bar, Quick Contact Budge, Analog Clock and Digital Clock, File Download.

**Intents and Broadcast Receivers:** Introduction to intents, Types of intent, creating intents and broadcast receivers

**App functionality beyond UI:** Threads, Async task, Services-states and life cycle, Notifications, Telephony and SMS APIs.

### Section – C

**Native Data Handling:** On-device file I/O, Shared Preferences, Mobile database (SQLite) and Enterprise Data Access via internet/intranet.

**Graphics and Animations:** Custom views, Canvas, Animation APIs.

**Multimedia:** Audio, Video and Images, Playback and record, Location awareness and Native hardware access.

### Section – D

**Testing Mobile Apps:** Debugging mobile apps, White box

### Section – A

**Introduction to Android Development:** Overview of the Android platform and its architecture, setting up the development environment for Android Studio, Understanding the Android project structure and application components.

**Android User Interface (UI) Design:** Introduction to Android UI components, Views, Lsayouts, Building UI using XML and Android layout resources, Handling user input and events, Using styles and themes to customize UI.

### Section – B

**Activities and Intents:** Understanding Android activities and their lifecycle, Creating and managing multiple activities, Interacting between activities using intents, Handling implicit and explicit intents.

**Fragments and Broadcast Receivers:** Introduction to fragments and their lifecycle, Building flexible UIs with fragments, Communicating between fragments, broadcast receivers.

**App functionality beyond UI:** Threads, Async task, Services-states and life cycle, Notifications, Telephony and SMS APIs.

### Section – C

**RecyclerView and Adapters:** Working with RecyclerView to display lists and grids, creating custom adapters to populate RecyclerView.

**Native Data Handling:** On-device file I/O, Shared Preferences, SQLite Database and Enterprise Data Access via internet/intranet.

**Multimedia:** Custom views, Canvas, Animation APIs, Audio, Video and Images, Playback and record, Location awareness and Native hardware access.

### Section – D

**Testing Mobile Apps:** Debugging mobile apps, White box testing, Black box testing, Test automation of mobile apps, JUnit for android, Robotium and Monkey Talk.

**Taking apps to Market:** Versioning, Signing and packaging mobile apps, Distributing apps on mobile market place.

**Flutter:** Understanding flutter and its framework, Importance of Flutter, Flutter SDK and Widgets, Creating flutter app.

25%

Testing, Black box testing, Test automation of mobile apps, JUnit for android, Robotium and Monkey Talk.  
**Taking apps to Market:** Versioning, Signing and packaging mobile apps, Distributing apps on mobile market place.

**MCA-304(c): NoSQL Database**

**Section – A**

**Introduction about NoSQL:** What is Data and their types, what is NoSQL, History of NoSQL, Features and Characteristics of NoSQL, Types of NoSQL, Different NoSQL products, Advantages of NoSQL, Introduction to JSON, JSON Features, Querying Using JSON.

**Section – B**

**NoSQL Database:** RDBMS Vs NoSQL, Distribution Models: Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, BASE principle of NoSQL database.

**Key-Value Databases:** Introduction to Key-Value Databases, Essential Features of Key-Value Databases, Key-Value Database, Data Modelling Terms, Key-Value Architecture Terms, Key-Value Implementation Terms.

**Section – C**

**Document Databases:** Introduction to Document Database, Document Managing, Multiple Document in Collection, Basic Operations on Document Database, Types of Partitions, Data Modelling and Query Processing, Indexes and their types, Basics of MongoDB, Introduction of MongoDB, Installation and configuration setup, Data Modelling, administration, aggregation, and security processing, JSON/BSON, MongoDB CRUD I, MongoDB CRUD II, Indexing in MongoDB, MongoDB Sharding.

**Section – D**

**Column Databases:** Introduction to Column Family Databases, Column Family Databases Features, Column family Database Vs Relational Database, Basic Components of Column Family database, Utilizing Dynamic Control over Column, indexing by row, column name and Time Stamp, Reading and Writing Atomic Rows.

100%

Section – A

**Introduction:** Artificial Intelligence, Hard or Strong AI, Soft or Weak AI, knowledge, Turing test, characteristics and applications of AI.

**Problem Representation:** State space representation of problems, problem reduction representation, truth maintenance system.

**Game Playing:** Introduction, min-max algorithm, alpha-beta pruning.

**Search Strategies:** Strategies for state space search-data driven and goal driven search

Section – B

**Exhaustive Searches:** Depth-first search Algorithm; Breadth-first search Algorithm; Compare depth-first and breadth-first search;

**Heuristic Search:** Hill climbing, best first, A\*, AO\* algorithm, beam search, mean-end analysis. Properties of search Algorithms-Admissibility, Monotonicity, Informedness

Section – C

**Logic:** Syntax and semantic for propositional logic, FOPL, Clausal form, inference rules, resolution and unification, SLD resolution, CUT predicate, FAIL predicate, NOT predicate, HORN clause, forward chaining and backward chaining.

**Knowledge Representation:** Network Representation- Associative network & conceptual graphs, conceptual dependencies, structured representation- Frames & Scripts.

Section – D

**NLP:** Introduction, advantages and disadvantages of NLP, component of NLP, phases of NLP, recursive transitions nets (RNT), augmented transition nets (ATN).

**Expert systems:** Architecture, Characteristics of expert system, managing uncertainty in expert systems (Bayesian probability theory and Fuzzy logic), Knowledge Acquisition.

**Biology-inspired AI techniques:** Neural Networks,

Section – A

**Introduction:** Artificial Intelligence, Hard or Strong AI, Soft or Weak AI, knowledge, Turing test, Characteristics and applications of AI.

**Problem Representation:** State space representation of problems, Problem reduction representation, Truth maintenance system.

**Game Playing:** Introduction, Min-Max algorithm, Alpha-beta pruning.

**Intelligent Agents:** Definitions of a rational agent, Reflex, Model-based, Goal-based, utility-based agent

Section – B

**Exhaustive Searches:** Depth-first search Algorithm; Breadth-first search Algorithm; Compare depth-first and breadth-first search, **Heuristic Search:** Hill climbing, Best first, A\*, AO\* algorithm, Beam search, Mean-end analysis. Properties of search Algorithms: Admissibility, Monotonicity, Informedness.

Section – C

**Logic:** Syntax and semantic for propositional logic, FOPL, Clausal form, Inference rules, Resolution and unification, SLD resolution, CUT predicate, FAIL predicate, NOT predicate, HORN clause, Forward chaining and backward chaining. **Knowledge Representation:** Network Representation, Associative network & conceptual graphs, Conceptual dependencies, Structured representation: Frames & Scripts. **Planning:** Basic representation for planning, Symbolic-centralized vs. reactive-distributed, Partial order planning algorithm.

Section – D

**NLP:** Introduction, advantages and disadvantages of NLP, component of NLP, phases of NLP, recursive transitions nets (RNT), augmented transition nets (ATN).

**Expert systems:** Architecture, Characteristics of expert system, Knowledge Acquisition.

**Soft Computing:** Overview of Soft Computing, Difference Between Neural Network, Fuzzy Logic and Genetic Algorithm, Applications of Soft Computing

15%

**Section - A**

**Software Project Management:** Basic of Project management Conventional approach, Software Project Management phases, Boehm's top 10 industrial software metrics, software process models-linear sequential model-prototyping model- RAD model incremental, spiral, component, assembly and concurrent development models.. Software cost estimation process, Modern trends of SPM for Improving software economics, software processes and team effectiveness, Round-trip engineering, Principles of modern software management.

**Section - B**

**A software management process framework:** Life cycle phases - inception, elaboration, construction and training phase. Artifacts of the process - the artifact sets, management artifacts, engineering artifacts, pragmatics artifacts. Model based software architectures. Workflows of the process. Checkpoints of the process. Software project planning: Planning objectives - software scope-resources software project estimation

**Section - C**

Software management disciplines: Iterative process planning. Project organizations and responsibilities. Process automation. Project control and process instrumentation - core metrics, management indicators, life cycle expectations. Process discriminants.

**Section - D**

Quality Analysis: Quality Controls, Formal approaches to SQA - the ISO 9000 quality Formal technical review of quality, Project Appraisal Review, Project status reporting, post project review and Maintenance.

**Section - A**

**Software Project Management:** Basic of Project management Conventional approach, Software Project Management phases, Boehm's top 10 industrial software metrics, software process models-linear sequential model-prototyping model- incremental, spiral, component, assembly and concurrent development models.. Software cost estimation process, Modern trends of SPM for Improving software economics, software processes and team effectiveness, Round-trip engineering, Principles of modern software management ,conventional software engg, Peer inspection,A Pragmatic view

**Section - B**

**A software management process framework:** Life cycle phases - inception, elaboration, construction and training phase. Artifacts of the process - the artifact sets, management artifacts, engineering artifacts, pragmatics artifacts. Model based software architectures. Workflows of the process. Checkpoints of the process. Software project planning: Planning objectives - software scope-resources software project estimation, various teams and its structure, Model based software architecture: A management perspective.

**Section - C**

Software management disciplines: Iterative process planning. Project organizations and responsibilities. Process automation. Project control and process instrumentation - core metrics, management indicators, life cycle expectations. Process discriminants. stakeholder environment,small scale vs large scale projects

**Section - D**

Quality Analysis: Quality Controls, Formal approaches to SQA - the ISO 9000 quality Formal technical review of quality, Project Appraisal,Six Sigma, verification and validation Review, Project status reporting, post project review and Maintenance.

20%

Section – A

**Introduction:** Learning, Types of learning, Well defined learning problems, Designing a learning system, History of ML, Goals and applications of machine learning, Issues in Machine Learning, Data Science Vs Machine Learning, Intelligent autonomous systems, characterization of learning problems, Object categories and features.

**Aspects of developing a learning system:** Training data, Concept representation.

**Types of Machine Learning:** Supervised, Unsupervised, Reinforcement, Deep learning, Deep Reinforcement learning

Section – B

**Machine Learning Processes:** Feature Extraction, Feature Correlation, Feature Transform, Train Model, Ensemble, Data cleaning, Data Transform/ Overfitting.

**Supervised Learning:** Classification, Random Forest, Decision Trees, Logistic Regression, Support Vector Machines, KNN, Naïve Bayes, Regression, Linear Regression, Regularization Techniques (LASSO), Polynomial Regression

Section – C

**Clustering and Unsupervised Learning:** Learning from unclassified data, Clustering, Hierarchical Agglomerative Clustering, k-means partitional clustering, Expectation-maximization (EM) for soft clustering, Semi-supervised learning.

Section – D

**Artificial Neural Network:** Neural network representation, Neural Networks as a paradigm for parallel processing, Linear discrimination, Pairwise separation, Gradient Descent, Logistic discrimination, Perceptron, Training a perceptron.

**Genetic Algorithms:** Basic concepts, Genetic programming, Models of evolution and learning, Parallelizing Genetic Algorithms.

Section – A

**Introduction:** Learning, Types of learning, Perspective and Issues, Finite and Infinite Hypothesis Space, History of ML, Goals and applications of machine learning, Issues in Machine Learning, Data Science Vs Machine Learning, Intelligent autonomous systems, characterization of learning problems, Object categories and features.

**Aspects of developing a learning system:** Training data, Concept representation.

**Types of Machine Learning:** Supervised, Unsupervised, Reinforcement, Deep learning, Deep Reinforcement learning

Section – B

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**Supervised Learning:** Classification, Random Forest, Decision Trees, Logistic Regression, Support Vector Machines, KNN, Naïve Bayes, Regression, Linear Regression, Regularization Techniques (LASSO), Polynomial Regression. Basic definitions, Hypothesis space and inductive bias, Bayes optimal classifier and Bayes error, Occam's razor, Curse of dimensionality, dimensionality reduction, feature scaling, feature selection methods

Section – C

**Clustering and Unsupervised Learning:** Learning from unclassified data, Clustering, Hierarchical Agglomerative Clustering, k-means partitional clustering, Expectation-maximization (EM) for soft clustering, Semi-supervised learning.

**Classification:** Decision trees, Naive Bayes classifier, k-nearest neighbor classifier, perceptron, multilayer perceptron, back-propagation algorithm, Kernel functions.

Section – D

**Artificial Neural Network:** Neural network representation, Neural

16%

**Applications based Machine Learning:** Healthcare, Hospitality, Cloud Based ML Offerings and IOT Based ML Offerings.

Networks as a paradigm for parallel processing, Linear discrimination, Pairwise separation, Gradient Descent, Logistic discrimination, Perceptron, Training a perceptron.  
**Genetic Algorithms:** Basic concepts, Genetic programming, Models of evolution and learning, Parallelizing Genetic Algorithms.  
**Applications based Machine Learning:** Healthcare, Hospitality, Cloud Based ML Offerings and IOT Based ML Offerings.

**MCA-402: Open Source Technology Using PHP**

**Section – A**

**Introduction to PHP:** Start and End Tags of PHP, Data types in PHP, Variables, Constants, Operators and Expressions, Printing data on PHP page, Control statements – if, switch case, for, while, do while.

**Arrays:** Initialization of an array, Iterating through an array, Sorting arrays, Array Functions, Functions: Defining and Calling Functions, Passing by Value and passing By references, Inbuilt Functions.

**Section – B**

**Working with Forms:** Get and Post Methods, Query strings, HTML form controls and PHP, Maintaining User State: Cookies, Sessions, Application State.

**Working with Files:** Opening and Closing Files, Reading and Writing to Files, Getting Information on Files.

**Section – C**

**PHP Database Connectivity:** Introduction to MYSQL, Creating database and other operations on database, connecting to a database, Use a particular database, Sending query to database, Parsing of the query results, Checking data errors.

**Section – D**

**PHP Frameworks:** Introduction to PHP frameworks, Features PHP frameworks, Concepts, Local environment setup, Text editor, Installation on UNIX/Linux/Windows OS. Introduction to WordPress, Setting WordPress: Dashboard settings, General setting, Writing setting, Reading setting, WordPress categories,

**Section – A**

**Introduction:** Definition and history, Server-side scripting language, Advantages of using PHP for web development, Basic syntax rules, Data types: scalar, compound, and special types, Operators: arithmetic, logical, and comparison operators.

**Variables, Constants, and Arrays:** Declaring variables and assigning values, Constants: defining and using constants, Arrays: indexed arrays, associative arrays, and multidimensional arrays.

**Section – B**

**Control Structures:** Conditional statements: if-else, switch-case statements, Loop statements: for, while, do-while loops, Break and continue statements.

**Functions and Parameters:** Defining and using functions, Passing parameters to functions, Variable scope.

**Object-Oriented Programming Concepts:** Introduction to object-oriented programming, Defining classes and objects, Inheritance and polymorphism.

**Section – C**

**Web Application Development:** Overview of web development, Client-side and server-side scripting, PHP in web development.

**Creating Dynamic Web Pages:** Embedding PHP code in HTML, Displaying dynamic content, Creating forms, Retrieving form data, Validating form data, Processing form data, Understanding sessions, Starting and destroying sessions, Storing and retrieving session data.

**Section – D**

50%

**Database Connectivity:** Overview of databases, Introduction to MySQL, Connecting to a database, Retrieving data from a database, Manipulating data, Preparing SQL, Creating records in a database, Reading records from a database, Updating records in a database, Deleting records from a database.

**MCA-403(a): Blockchain Technology**

**Section – A**

Introduction to Blockchain: History, Need for Distributed Record Keeping, Modelling faults and adversaries, The consensus problem and their scalability problem, Byzantine Generals problem, Blockchains with Nakamoto consensus. Abstract Models for Blockchain - GARAY model - RLA Model - Proof of Work ( PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake ( PoS) based Chains - Hybrid models ( PoW + PoS).

**Section – B**

Cryptographic Fundamentals: Cryptographic basics for crypto currency- a short overview of Hashing. Cryptographic algorithm – SHA 256, signature schemes. Technologies Used in Blockchain:– Hash pointers, Consensus, Byzantine Models of fault tolerance, digital cash. Bitcoin blockchain - Wallet - Blocks - Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin. Bitcoin, the challenges, and solutions.

**Section – C**

ETHEREUM Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges-

**Section – A**

Introduction – History, Need for Distributed Record Keeping, how block chain is changing the landscape of digitalization, Basic Distributed System concepts – distributed consensus and atomic broadcast, Modeling faults and adversaries, Byzantine Generals problem Consensus algorithms & their scalability problems, Byzantine fault-tolerant consensus methods. Basic Blockchain– concepts germane to Bitcoin and contemporary proof-of-work based consensus mechanisms, operations of Bitcoin blockchain, Blockchains with Nakamoto consensus. Models for Blockchain – GARAY model , backbone model, Proof of Work ( PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake ( PoS) based Chains - Hybrid models ( PoW + PoS). crypto-currency as application of blockchain.

**Section – B**

Introduction to cryptographic concepts, public key cryptosystems, Cryptographic basics for crypto currency- a short overview of Hashing (Secure, Collision-resistant hash functions, digital signature, public key cryptosystems, zero-knowledge proof systems, SHA 256), private vs public block chain and use cases, examples of Hash Puzzles Introduction to Bitcoin Blockchain: Technologies Used in Blockchain:– Hash pointers, NONCE, Consensus, BFT vs.PBFT, digital cash, Wallet - Blocks - Merkle root,hardness of mining – transaction verifiability - Pseudo-anonymity vs. anonymity– forking ( types of forking : hard & soft) -Double spending problem & solution - mathematical analysis of properties of Bitcoin, challenges, solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus

**Section – C**

60%



Section – D

Blockchain Implementation Challenges- Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks.

ETHEREUM Terminology; Ethereum Virtual Machine (EVM) – Ether, Gas, Wallets- Solidity - Smart Contracts: The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts Ethereum Smart Contracts (Permissionless Model vs Hyperledger Fabric (Permissioned Model)

Section – D

Block chain Challenges- Zero Knowledge proofs Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks -advent of algorand, and Sharding based consensus algorithms to prevent attacks.Limitations of blockchain as a technology, myths vs. reality of blockchain, Research directions in Blockchain technology

Section – A

MCA-403(c): Design and Analysis of Algorithm

**Introduction:** Elementary Data Structures, Introduction to Algorithms and their Characteristics, Designing and Analyzing algorithm, Concept of algorithmic efficiency, Algorithms & its complexity (Time & Space), Run time analysis of algorithms, Asymptotic Notations, recurrence relations.

**Divide and Conquer:** Structure of divide and conquer algorithms, Linear Search, Jump Search, Binary Search, Interpolation Search, Bubble Sort, Cocktail Sort, Heap Sort, Quick Sort, Merge Sort, Strassen Multiplication, Analysis of divide and conquer at run time.

Section – B

**Greedy Method:** Overview of the Greedy Paradigm, Huffman codes solution minimum cost spanning tree (Kruskal's and Prim's Algorithm), approximate solution (Knapsack problem), Single source shortest paths.

**Dynamic Programming:** Elements, Overview, Applications: Shortest path in graph, Matrix Multiplication, Longest Common sequence, Dijkstra's Algorithm, Bellman- Ford

Section – A

**Introduction:** Elementary Data Structures, Introduction to Algorithms and their Characteristics, role of algorithms in computing Designing and Analyzing algorithm, Concept of algorithmic efficiency, Algorithms & Time & Space complexity, Run time analysis of algorithms, Asymptotic Notations, recurrence relations.

**Divide and Conquer:** Complexity of iterative programs and recursive programs, solving recurrence equations: back substitution method, recursion tree method, masters theorem, Structure of divide and conquer algorithms, Linear Search, Jump Search, Binary Search, Interpolation Search, Bubble Sort, Cocktail Sort, Heap Sort, Quick Sort, Merge Sort, Lower bounds for sorting, Strassen Multiplication, Analysis of divide and conquer at run time.

Section – B

**Hash Tables:** Hash functions, Collision handling in hashing, analyzing various operations on Binary search tree. Introduction to Red-black trees

**Greedy Method:** Overview of the Greedy Paradigm, Element of Greedy Method, Huffman codes solution minimum cost spanning tree ,Kruskal's and Prim's Algorithm, Approximate solution, Knapsack problem, Single source shortest paths.

40%

### Section – C

**Back Tracking:** Overview, 8-queen problem, Hamiltonian path and circuit, Graph Coloring Problem and Knapsack problem.

**Branch and Bound:** LC Searching, Bounding, FIFO Branch and Bound, LC Branch and Bound, Application: 0/1 Knapsack Problem, Traveling Salesman Problem.

### Section – D

**Graph Searching and Traversal:** Overview, Depth first and Breadth First search traversal methods, Trees: Review of Trees, Binary Search Tree, Insertion & Deletion in Binary Search Tree, B-Trees, Basic operations on B-Trees, Red black trees, Splay Trees.

**Computational Complexity:** Complexity measures, Polynomial vs. non-polynomial time complexity; NP-hard and NP-complete classes, examples, Ford- Fulkerson method, Maximum bipartite matching, Sorting Networks, Comparison

**Dynamic Programming:** Elements, Overview, Applications: Shortest path in graph, Matrix Multiplication, Longest Common sequence, Dijkstra's Algorithm, Its Analysis & Limitation Limitations of Dijkstra's Algorithm, Negative weight cycle, Bellman- Ford algorithm

**All Pairs Shortest Path:** Relation of Shortest path and matrix multiplication, Analysis of Floyd Warshall algorithm. Maximum Flow: Flow network, Ford-Fulkerson method.

### Section – C

**Back Tracking:** Overview, 8-queen problem, Hamiltonian path and circuit, Graph Coloring Problem and Knapsack problem.

**Branch and Bound:** LC Searching, Bounding, FIFO Branch and Bound, LC Branch and Bound, Application: 0/1 Knapsack Problem, Traveling Salesman Problem, Strings: Storage of strings, naive string-matching algorithm, Rabin-Karp string matching algorithm.

### Section – D

**Graph Searching and Traversal:** Overview, Depth first and Breadth First search traversal methods, Trees: Review of Trees, Binary Search Tree, Insertion & Deletion in Binary Search Tree, B-Trees, Basic operations on B-Trees, Red black trees, Splay Trees.

**Computational Complexity:** Complexity measures, Polynomial vs. non-polynomial time complexity; NP-hard and NP-complete classes, examples, Ford- Fulkerson method, Maximum bipartite matching, Traveling Salesman Problem, Knapsack, Bin Packing, Satisfiability, Vertex Cover, Clique, Independent Set, Sorting Networks, Comparison network, Zero- one principle, Bitonic sorting network, merging network.

network; Zero- one principle, Bitonic sorting network, merging network.

**Section – A**

**MCA-404(a): Big Data**

**Section – A**

8%

**Introduction:** Introduction to Big Data Platform, Challenges of Conventional Systems, Data Types: Structured, Semi-Structured and Unstructured.

**Introduction:** Introduction to Big Data Platform, Challenges of Conventional Systems, Data Types: Structured, Semi-Structured and Unstructured,

**Big Data:** Descriptive, Predictive and Prescriptive, Traditional vs Big Data Environment, Big Data Technology Landscape: SQL, NoSQL, NoSQL Databases, New SQL, CAP Theorem.

**Big Data:** Descriptive, Predictive and Prescriptive, Traditional vs Big Data Environment, Big Data Technology Landscape: SQL, NoSQL, NoSQL Databases, New SQL, CAP Theorem.

**Data Analytics:** Classification of analytics, drawing prediction from data. Data Models and Computing models: Distributed and Parallel Computing for Big Data, Cloud Computing and Big Data, In-memory Computing for Big Data.

**Data Analytics:** Classification of analytics, drawing prediction from data. Data Models and Computing models: Distributed and Parallel Computing for Big Data, Cloud Computing and Big Data, In-memory Computing for Big Data.

**Section – B**

**Section – B**

**Hadoop:** Introduction, key advantages of Apache Hadoop, Hadoop vs. RDBMS, Hadoop Architecture, Blocks, Name nodes, Data nodes, Hadoop components, HDFS Design and goals, anatomy of file read and write in HDFS, Replica placement strategy, Working with HDFS Commands, Hadoop file system interfaces, Hadoop 1.0 vs Hadoop 2.0, Hadoop Echo System

**Hadoop:** Introduction, key advantages of Apache Hadoop, Hadoop vs. RDBMS, Hadoop Architecture, Blocks, Name nodes, Data nodes, Hadoop components

**Hadoop installation:** Standalone modes and fully distributed mode.

**HDFS(Hadoop Distributed File System):** HDFS Design and goals, anatomy of file read and write in HDFS, Replica placement strategy, Working with HDFS Commands, Hadoop file system interfaces, Hadoop 1.0 vs Hadoop 2.0 vs Hadoop 3.0, Hadoop Echo System

**YARN:** Architecture for Resource Management

**Hadoop installation:** Standalone modes and fully distributed mode. Loading data into Hadoop, Handling files in Hadoop, Getting data from Hadoop

**YARN:** Architecture for Resource Management

**Section – C**

**Section – C**

**Map Reduce:** Understanding Map-Reduce framework, Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features, SQL vs. Map Reduce.

**Map Reduce:** Understanding Map-Reduce framework, Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

**Hadoop Streaming:** Data streaming, Data Flow Models, Stream Data Model and Architecture, Limitations of Map-Reduce

**Hadoop Streaming:** Data streaming, Data Flow Models, Stream Data Model and Architecture, Limitations of Map-Reduce

**Section – D**

**PIG:** Introduction, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing

**Section – D**

**PIG:** Introduction, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. **Hive:** Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.

**Hbase:** HBasics, Concepts, Clients, Example, Zookeeper, Hbase vs. RDBMS. Big SQL. **Sqoop:** Sqoop Architecture, Installation, connectors & drivers, importing and exporting data from HDFS, HIVE, HBase. **Flumes:** Features, Architecture.

operators.

**Hive:** Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.

**Hbase:** HBasics, Concepts, Clients, Example, Zookeeper, Hbase vs. RDBMS. Big SQL.

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**Flumes:** Features, Architecture.

MCA-404(b): Data Mining & Warehousing

**Section – A**

**Data Warehousing :** The Evolution Of Data Warehousing , Today's Development Environment, Types of Data and their Uses, Conceptual Data Architecture, Introduction to the Logical Architecture, Data Modeling, Schema Design, Star and Snow-Flake Schema, Fact Constellation, Fact Table.

**Data Mining:** Introduction: Motivation, Importance, Fundamentals of data mining, kind of data, Functionalities, Data Mining Task Primitives, interesting patterns, Classification of data mining systems, Major issues.

**Section – B**

**Data Warehouse and OLAP Technology for Data Mining:** Data warehouse, operational database systems and data warehouses, Architecture,

Implementation, development of data cube technology, data warehousing to data mining, Data warehouse usage, Knowledge Discovery Process, OLAP Cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP.

**Data Preparation:** Need for Preprocessing the Data, Data cleaning, Data integration and transformation, Data reduction, Discretization and concept hierarchy generation.

**Section – A**

**Data Warehousing :** The Evolution Of Data Warehousing , Today's Development Environment, Types of Data and their Uses, Conceptual Data Architecture, Introduction to the Logical Architecture, Data Modeling, Schema Design, Star and Snow-Flake Schema, Fact Constellation, Fact Table.

**Data Mining:** Introduction: Motivation, Importance, Fundamentals of data mining, kind of data, Functionalities, Data Mining Task Primitives, interesting patterns, Classification of data mining systems, Major issues. Application areas of Data Mining.

**Section-B**

**Data Warehouse and OLAP Technology for Data Mining:** Data warehouse, operational database systems and data warehouses, Architecture, Implementation, development of data cube technology, data warehousing to data mining, Data warehouse usage, Knowledge Discovery Process, OLAP Cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP.

**Data Preparation:** Need for Preprocessing the Data, Data cleaning, Data integration and transformation, Data reduction, Discretization and concept hierarchy generation. Feature Extraction, feature transformation, feature selection.

10%

**Section – C**

**Concept Description:** Characterization and Comparison, Data generalization and summarization-based characterization, Analytical characterization, analysis of attribute relevance, Mining class comparisons, Mining descriptive statistical measures in large databases.

**Classification and prediction:** Problem Definition, General Approaches to solving a classification problem, classification by decision induction, Bayesian classification, classification by back propagation, classification based on concepts from association rule mining other classification methods

**Prediction:** Accuracy and Error measures, Evaluating the accuracy of a classifier or a predictor, Ensemble methods

**Section – D**

**Mining Association Rules in Large Databases:** Mining single-dimensional, multilevel association rules from transaction databases, Mining multidimensional association rules from relational databases and data warehouses, From association mining to correlation analysis, Constraint-based association mining.

**Section- C**

**Concept Description:** Characterization and Comparison, Data generalization and summarization-based characterization, Analytical characterization, analysis of attribute relevance, Mining class comparisons, Mining descriptive statistical measures in large databases.

**Classification and Prediction:**

Classification vs. prediction, classification and prediction Issues, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms, Neural Network-Based Algorithms, Rule-Based Algorithms, Combining Techniques, accuracy and error measures,

evaluationoftheaccuracyofaclassifierorpredictor.NeuralNetworkPredictionmethods: Linear and nonlinear regression, Logistic Regression Introduction of tools such as DBMiner/WEKA/DTREGDM Tools

**Section- D**

**Mining Association Rules in Large Databases:** Mining single-dimensional, multilevel association rules from transaction databases, Mining multidimensional association rules from relational databases and data warehouses, From association mining to correlation analysis, Constraint-based association mining.

**Cluster Analysis:** Introduction to outlier analysis.Clustering,ProblemDefinition,ClusteringOverview,Classifications of Clustering Algorithms

**MCA-404(c): Internet of Things**

**Section – A**

**Introduction -** What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.

**Section – B**

**IOT Protocols -** Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX

**Section – A**

**Introduction:** Overview and Importance, Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues, IoT Enabling techniques.

**Section – B**

**IOT Architecture:** OIC Architecture & Design principles, IoT Devices and Deployment models, IoTivity: Overview, IoTivity Stack Architecture: Resource Model and Abstraction, Reference model for IoT.

**Section – C**

30%

Network layer – APS layer – Security.

**Section – C**

**IOT Architecture** - IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity: An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.

**Section – D**

**WEB of Things** - Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

**IOT Applications** - IoT applications for industry: Future Factory Concepts, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware.

**IOT Protocols:** Principles of Edge/P2P Networking, Advantages of Low Power Mesh Networking, Real World Constraints, Link Layer Protocols, Network Layer Protocols, Transport Layer and Application Layer protocols.

**Section – D**

**WEB of Things:** Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Unified Multitier WoT Architecture, WoT Portals and Business Intelligence.

**IOT Applications:** IoT applications for industry: Future Factory Concepts, Smart Objects, Smart Applications, Study of existing IoT platforms/middleware.

Embedded System platforms for IoT: Arduino and Raspberry Pi.

**Benchmark:**

Delhi University, Visvesvaraya Technological University, GurukulaKangri (Deemed to be University), Haridwar, Bennet University, Indian Institute of Technology, Bombay, Punjab University, Chitkara University, Kurukshetra University, Gujrat Technological University, APJ Abdul Kalam Technical University, Lucknow, Indian Institute of Technology, Kharagpur, Indian Institute of Technology, Madras, Indian Institute of Technology, Kanpur, Amity University, Thapar University, National Institute of Technology, Kurukshetra

The above revision/change has been approved by the following academic bodies:

1. Board of Studies vide resolution no. 04 dated 17-07-2023
2. Faculty of Engineering & Technology vide resolution no. \_\_\_\_\_ dated \_\_\_\_\_
3. Academic Council vide resolution no. \_\_\_\_\_ dated \_\_\_\_\_

**PRINCIPAL**

- Zigbee- Network layer – APS layer – Security.

**Section – C**

**IOT Architecture** - IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity: An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.

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**The above revision/change has been approved by the following academic bodies:**

1. Board of Studies vide resolution no. 04 dated 17/07/2023
2. Academic Council vide resolution no. 14 dated 17/11/2023

Principal  
M.M. Institute of Computer Technology  
& Business Administration  
Maharaja Ganga Pratap  
(Deemed to be University)  
Murli Prasad  
**PRINCIPAL**