

**GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD**  
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**Scheme & Syllabus of  
Master of Computer Applications  
(MCA)  
2 Years Batch 2020 onwards  
(w.e.f. Academic Year 2022-23)**

**FYMCA  
Semester-I and Semester-II**

**By  
Departmental Board of Study  
(Master of Computer Applications)  
Department of Master of Computer Application  
Government College of Engineering, Aurangabad**

MC1101 : Data Structures and Algorithms		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : --	ISE II*	20 Marks
Credits : 03	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand fundamentals of data structures.
- CO 2 Analyse and apply linear data structures: Stacks, Queues, Lists to solve problems.
- CO 3 Analyse and apply non- linear data structures: Graphs, trees, to solve problems.
- CO 4 Design and implementation of data structures and algorithms.
- CO 5 Analyse the searching and hashing techniques.

### Course Contents

Unit No	Detailed Contents
1	Data types. Object, data structure and abstract data types (ADT), Arrays in C, Structures in C, Classes in C++, Primitive operations in stack, representing stacks in C, example- infix, postfix and prefix, efficiency of algorithm, algorithm analysis, Analysis – Big-Oh, Theta, Omega
2	Queues and its representation, priority queue, array implementation, stacks, operations in stack, array implementation of lists, linked lists using dynamic variables, examples of list operations in C, circular lists, header nodes, doubly linked list, examples.
3	Trees, applications of trees, operations in binary trees, tree traversals, evaluating an expression tree, binary search trees, optimal and average BST's trees and red-black trees Sorting: merge, quick, radix, selection, heap Introduction to Graphs, Breadth first search, Depth first search
4	Spanning trees: Prim's and Kruskal's algorithm, union-find data structure, Dijkstra's algorithm for shortest path. Shortest path tree. Shortest and longest paths in directed acyclic graphs
5	Searching and Hashing algorithms. Search algorithms – Sequential Search, Ordered lists, binary search. Searching using Hashing. Hash tables. Hash functions. Some examples of hash functions. Collision resolution.

### Text Books

- 1 Aaron M. Tanenbaum, “Data Structures using C and C++”, Pearson Education India, ISBN: 9788131702291
- 2 E. Horowitz, S. Sahni, S. Anderson-freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, ISBN 978-81-7371-605-8



### Reference Books

- 1 Jean-Paul Tremblay, Paul. G. Soresan, “An introduction to data structures with Applications”, Tata Mc-Graw Hill International Editions, 2nd edition 1984, ISBN-0-07-462471-7
- 2 Data Structures and Algorithms. Aho, Ullman & Hopcroft, Pearson Education India, ISBN: 9788177588262
- 3 Purely Functional Data Structures, Chris Okasaki, Cambridge University Press; ISBN: 9780521663502
- 4 Data & File Structures Using C, Reema Thareja, Oxford University Press, ISBN: 9780198099307

### E Books/ Online learning material

- 1 <https://nptel.ac.in/courses/106/102/106102064/>

### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1												1	
CO 2	1	2	2	1									1	2	
CO 3	1	2	2	1									1	2	
CO 4	1	3	3	1	2				2				1	2	
CO 5	1	3	2	1									1	2	

### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	10	5	-	5	-
ISE II* 20 Marks	-	5	5	5	5
ESE Assessment 60 Marks	6	18	12	12	12

### Assessment Pattern:

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	5	5	18
K2	Understand	10	5	18
K3	Apply	5	10	24
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60

MC1102 : Computer Programming		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : 01 Hrs / week	ISE II*	20 Marks
Credits : 04	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able

- CO 1 Understanding of computers, the concept of algorithm and algorithmic thinking.
- CO 2 Analyse the problem and select the most appropriate method to solve it.
- CO 3 Analyse and compare various programming constructs and apply the right one for the task.
- CO 4 Design the problem solution using modularity, repetition and advanced features of C programming language.
- CO 5 Evaluate the code, document, test, and implement a well structured, robust computer program.

### Course Contents

Unit No	Detailed Contents
1	<b>Introduction to C Language:</b> The C character set, Identifiers and keywords, Data types, Variables and Constants, Statements, Symbolic constants, Operators and expressions, Type conversion, Data input and output
2	<b>Control statement:</b> Branching - if else statement, Looping, Nested control structure, Switch statement, Break statement, Continue statement, GOTO statement. <b>Arrays:</b> Defining an array, one and two dimensional arrays, Strings: One dimensional character array, array of strings
3	<b>Functions:</b> Overview, function prototypes, function definition, passing arguments to a function, scope of variable names, recursion. <b>Program structure:</b> Storage classes, automatic variables, external variables, static variables, multi-file program. <b>Arrays:</b> Passing array to functions, String manipulation.
4	<b>Pointers:</b> Fundamentals, operation on pointers, accessing arrays through pointers, dynamic memory allocation, pointers and strings, pointers to function. <b>Structures and unions:</b> Defining a structure, operations on structures, passing structures as function arguments. Union.
5	<b>File Manipulation:</b> Opening and closing a data file, reading and writing a data file, processing a data file, unformatted data file, concept of binary file. <b>Low level programming:</b> Register variable, bitwise operations, bit fields. <b>Additional features of C:</b> Enumeration, Command line parameters, Macros.

### Text Books

- 1 Programming in ANSI C, E. Balagurusamy, TMH, ISBN: 9789353165130

**Reference Books**

- 1 Programming with C, Gottfried, TMH, ISBN: 9780070145900
- 2 C The Complete Reference, Schildt, TMH, ISBN: 9780070411838
- 3 The c programming language, Brian W Kernighan & Dennis Ritchie, 2<sup>nd</sup> Edition Eastern Economy Edition, Prentice Hall.
- 4 Let us C, Yashavant Kanetkar, BPB publication, Fifteenth Edition
- 5 Programming in C, Pradip Dey, Manas Ghosh, Oxford Higher Education.

**E Books/ Online learning material**

- 1 [www.cprogramming.com](http://www.cprogramming.com)
- 2 [www.learn-c.org](http://www.learn-c.org)
- 3 [www.coursera.org/specializations/c-programming](http://www.coursera.org/specializations/c-programming)
- 4 [www.w3resource.com/c-programming/programming-in-c.php](http://www.w3resource.com/c-programming/programming-in-c.php)
- 5 <http://nptel.ac.in/courses/106/104/106104128/>  
[www.swayam.gov.in](http://www.swayam.gov.in)

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1										1	1	
CO 2	1	2	2	2									1	2	
CO 3	1	2	3	2									1	2	
CO 4	1	2	3	2	2				1				1	2	
CO 5	1	2	3						1				3		

**Assessment Table:**

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	10	5	5	-	-
ISE II* 20 Marks	-	5	5	5	5
ESE Assessment 60 Marks	6	6	18	12	18

**Assessment Pattern:**

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	5	-	12
K2	Understand	5	-	18
K3	Apply	10	5	30
K4	Analyze	-	5	-
K5	Evaluate	-	5	-
K6	Create	-	5	-
<b>Total</b>		20	20	60

MC1103 : Database Management System		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : 01 Hrs / week	ISE II*	20 Marks
Credits : 04	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand various database models & entity relationship models.
- CO 2 Analyze data models to check the performance with respect to design and manipulations.
- CO 3 Apply structured query on database using SQL DDL/DML/DCL commands.
- CO 4 Implement a database schema for a given problem-domain.
- CO 5 Evaluate the normality of a logical data model, and correct any anomalies.

### Course Contents

Unit No	Detailed Contents
1	<b>Introduction to Databases:</b> Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. <b>Overview of Database Languages and Architectures:</b> Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data <b>Modelling using Entities and Relationships:</b> Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams examples, Specialization and Generalization.
2	<b>Relational Model:</b> Relational Model Concepts, Relational Model Constraints and relational database schemas, Keys, referential integrity and foreign keys. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Nested queries - correlated and uncorrelated, Notion of aggregation, Aggregation functions group by and having clauses, Embedded SQL
3	<b>Normalization:</b> Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multi-valued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. <b>Normalization Algorithms:</b> Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions
4	<b>Disk Storage, Basic File Structures, and Hashing:</b> Secondary Storage Devices, Buffering of Blocks, Placing File Records on Disk, Operations on Files, Hashing Techniques, Indexing Structures for Files, Single-Level Ordered Indexes Multilevel Indexes, Dynamic Multilevel Indexes Using B-Trees and B+-Trees

- 5 **Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.
- Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multi-version Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.
- Introduction to Database Recovery Protocols:** Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging,

### Text Books

- 1 R. Elmasri and S. Navathe, Fundamentals of Database Systems, Addison-Wesley.
- 2 Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication, Sixth Edition

### Reference Books

- 1 S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication,
- 2 An Introduction to Database System : Bipin Desai West Publications
- 3 R Ramakrishnan, J Gehrke, Database Management Systems, 3rd Ed., McGraw-Hill,
- 4 Thomas M. Connolly, Carolyn E. Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", Addison Wesley, fifth Edition

### E Books/ Online learning material

- 1 <https://nptel.ac.in/courses/106/105/106105175/>
- 2 <http://www.nptelvideos.in/2012/11/database-management-system.html>
- 3 <https://freevidelectures.com/course/2668/database-management-system>

### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	1	
CO 2	1	2							1				1	2	
CO 3	1	2	3	2	3				1				1	2	
CO 4	1	2	3	2					1				1	2	
CO 5	1	2	1						1					3	



**Assessment Table:**

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	10	10	-	-	-
ISE II* 20 Marks	5	-	5	5	5
ESE Assessment 60 Marks	12	6	18	18	6

**Assessment Pattern:**

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	10	05	18
K2	Understand	10	05	24
K3	Apply	-	05	18
K4	Analyze	-	05	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60





MC1104 : System Software & Operating System		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : --	ISE II*	20 Marks
Credits : 03	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand the fundamental concepts of System Software and Operating System.
- CO 2 Understand the functions of Assembler, Compiler and Macro
- CO 3 Understand the structure and design of assemblers, linkers and loaders.
- CO 4 Understand various CPU Scheduling & Memory Management algorithms.
- CO 5 Identify various design issues associated with System Software & Operating Systems.

### Course Contents

Unit No	Detailed Contents
1	<b>Assemblers</b> - General design procedure –design assembler, statement of problem, data structure, format of database, algorithm and flowchart of various passes of assembler. Macro-processor Macro-instruction, features of macro facility-Macro instruction argument, conditional macro expansion, macro calls within macros, macro instruction defining macros, implementation.
2	<b>Loader-</b> Loading schemes-compile and go, general loader, absolute loader, subroutine linkages, reloading loaders, direct linking loaders, binders, linking loaders, overlays, dynamic blinders, design of an absolute loader and designing of direct linking loader
3	<b>Compilers-</b> Introduction to design of compiler, phases of compiler. Data structures, recursion call and return statement, storage classes, implementation, block structure compiler writing tools.
4	<b>Operating system structures</b> - System components, operating system services, system programs, system structures. Process Management: Process Concept, Process scheduling, operations on processes, cooperating processes, inter-process communication, threads overview.
5	<b>CPU Scheduling</b> - Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Algorithm evaluation. Process Synchronization: The critical –Section problem, synchronization hardware, and semaphore, classic problems of synchronization, critical regions. <b>Deadlock</b> - System Model, Deadlock Characterization, Resource-Allocation Graph, Methods for Handling Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection. Memory Management: Concept, Memory Management Techniques, Swapping, Contiguous Memory Allocation, Memory Protection, Memory Allocation, Fragmentation, Paging, Basic Method, Segmentation with Paging, Virtual Memory Concept, Demand Paging, Page Replacement.

**Text Books**

- 1 System Programming by J. J. Donavan , TMH, ISBN 978-0074604823
- 2 Operating Systems: Concepts: By Abraham Siberschatz, Peter Galvin- Willey- Sixth edition.

**Reference Books**

- 1 Operating Systems: Andrew S. Tanenbaum-Pearson Education- Second Edition.
- 2 Introduction to system software by D. M. Dhamdhare, TMH
- 3 System Programming and Operating Systems by D.M. Dhamdhare -TMH –Second Edition.
- 4 Operating Systems: Internals and Design Principles, Seventh Edition by William Stallings, Pearson Publications

**E Books/ Online learning material**

- 1 Introduction to operating system <https://nptel.ac.in/courses/106/106/106106144/>

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1													
CO 2	1	1													
CO 3	1	1													
CO 4	1	1	2											2	
CO 5	1	1	2											2	

**Assessment Table:**

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	10	5	-	-
ISE II* 20 Marks	5	5	5	5	-
ESE Assessment 60 Marks	6	12	12	12	18

**Assessment Pattern:**

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	10	05	24
K2	Understand	10	05	24
K3	Apply	-	05	12
K4	Analyze	-	05	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60

MC1105 : Software Engineering		
Teaching Scheme	Examination Scheme	
Lectures : 04 Hrs / week	ISE I*	20 Marks
Tutorial : --	ISE II*	20 Marks
Credits : 04	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand and compare various Software Development Life Cycle models.
- CO 2 Identify user requirements and prepare System Requirement Specification document.
- CO 3 Prepare design as per System Requirement Specification document.
- CO 4 Write and apply appropriate test cases to the software system designed.
- CO 5 Integrate knowledge and skills to provide software maintenance to customer.

### Course Contents

Unit No

Detailed Contents

- 1 **Introduction to Software Engineering Basic Terminologies:** What is Software & its Characteristics, requirements, specifications, design, testing, validation, evolution and project management, Software Crises and Myths, Software Engineering as a Layered Technology, Software Development Lifecycle, Agile view of Process
- 2 **Software Process, requirements and specification:** Software Process, Process Framework, Generic and Umbrella activities, Process Patterns, Process Assessment, Various Process Models, Requirement Engineering -inception, elicitation, elaboration, negotiation, specification, validation & management, Analysis Modelling Techniques - UML Diagrams
- 3 **Software Design:** Translating analysis model into design model, Fundamental design Concepts and Principles, Design Process, Quality Attributes, Software Architecture & Architectural Styles.
- 4 **Software Testing, Validation & Maintenance:** Testing Strategy for Conventional Software, Testing Fundamentals, Test Plan Creation and Test Cases Generation, Unit and Integration Testing, Black-box and White-box Testing Techniques, Validation, and System Testing.
- 5 **Software Evolution:** Software Maintenance- Corrective, Adoptive, Perfective, Structured and Un-Structured, The Associated Disciplines and the Role and the Nature of the Configuration Management, Characteristics of Maintainable Software, Software Re-use strengths and weaknesses, Re-engineering.

### Text Books

- 1 Software Engineering – Roger S. Pressman, TMH, 7<sup>th</sup> Edition, ISBN- 978-0071267823

### Reference Books

- 1 William Perry, “Effective Methods for Software Testing”, John Wiley & Sons, New York, 1995.
- 2 Cem Kaner, Jack Falk, Nguyen Quoc, “Testing Computer Software”, Second Edition, Van Nostrand Reinhold, New York, 1993.



- 3 Boris Beizer, “Software Testing Techniques”, Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
- 4 Louise Tamres, “Software Testing”, Pearson Education Asia, 2002
- 5 K. K. Aggarwal , Yogesh Singh , “Software Engineering” , New Age International Publishers
- 6 Shrinivasan, Gopaldaswamy, “Software Testing” – Pearson Education

#### E Books/ Online learning material

- 1 NPTEL - <https://nptel.ac.in/courses/106/105/106105087/>
- 2 SWAYAM- [https://swayam.gov.in/nd1\\_noc19\\_cs69/preview](https://swayam.gov.in/nd1_noc19_cs69/preview)
- 3 COURSERA-<https://www.coursera.org/courses?query=software%20engineering>

#### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1														
CO 2	1	2								2				1	
CO 3	1	2	1							2				1	
CO 4	1	1													
CO 5	1	1													

#### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	10	10	-	-	-
ISE II* 20 Marks	5	5	-	5	5
ESE Assessment 60 Marks	18	18	6	6	12

#### Assessment Pattern:

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	10	5	24
K2	Understand	10	5	18
K3	Apply	-	-	18
K4	Analyze	-	5	-
K5	Evaluate	-	5	-
K6	Create	-	-	-
<b>Total</b>		20	20	60

MC1106 : Lab Data Structures and Algorithms		
Teaching Scheme	Examination Scheme	
Practical : 02 Hrs/Week	ISE I*	25 Marks
Credits : 01	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand linear and non-linear data structures.
- CO 2 Implement linear and non-linear data structures with high level language.
- CO 3 Apply & evaluate various searching, sorting and hashing algorithms.

**Course Contents (Indicative List of Experiments not restricted to)**

- 1 Write a program for implementing Stack and Queue.
- 2 Write a program for Singly Linked List and Doubly Linked List.
- 3 Write a program for Circular Queue using Linked List.
- 4 Write a program for Creation of Binary Tree and operations on it.
- 5 Write a program for Creation of Binary Threaded Tree.
- 6 Write a program for Depth First search and Breadth First search.
- 7 Write a program for Bubble Sort and Bucket Sort.
- 8 Write a program for Merge Sort and Heap Sort.
- 9 Write a program for Insertion Sort and Quick sort.
- 10 Write a program for Binary Search to search an element in the given sequence.

**Assessment:** Practical Examination will consist of Performance and Viva-voice Examination. The assessment will be based on the following–

1. Performance in the practical examination.
2. Record of programs submitted by the candidate.

**Assessment Pattern:**

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	10	10
S2	Manipulation	05	05
S3	Precision	05	05
S4	Articulation	05	05
S5	Naturalization	--	--
<b>Total Marks</b>		<b>25</b>	<b>25</b>

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											2	1	
CO 2	1	2	3										2	1	
CO 3	1	2	3										2	1	

MC1107 : Lab Computer Programming		
Teaching Scheme	Examination Scheme	
Practical : 04 Hrs/Week	ISE I*	50 Marks
Credits : 02	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand various programming problem specifications.
- CO 2 Design a high-level (programming language independent) solution to the problem.
- CO 3 Write, compile, execute and debug a C program which maps the high-level design onto concrete C programming constructs.

**Course Contents(Indicative List of Experiments not restricted to)**

1. Write a program to rotate values of variables X, Y, Z such that  $X \rightarrow Y, Y \rightarrow Z, Z \rightarrow X$ .
2. Write a program to find factorial of a number.
3. Write a program to list prime numbers from 1 to 500 using for statement.
4. Write a program to test whether given number is palindrome using do while statement.
5. Write a program to test number is an Armstrong number using if and go to statement.
6. Write a program to find square, square root, cube, cube root using switch case
7. Write a program to test whether given number is prime using function.
8. Write a program to demonstrate call by value parameter passing technique.
9. Write a program to demonstrate call by reference parameter passing technique.
10. Write a recursive program to test whether given number is prime.
11. Write a program to display strong number from n to m by command line argument.
12. Write a program to search a number in the given array.
13. Write a program to multiply matrix A with B.
14. Write a program to sort an array using pointer.
15. Write a program to demonstrate nested structure.
16. Write a program to demonstrate bit fields in a structure.
17. Write a program to copy one file into another file.

**Assessment:**

Practical Examination will consist of Performance and Viva-voice Examination. The assessment will be based on the following–

1. Performance in practical examination.
2. Record of programs submitted by the candidate



**Assessment Pattern:**

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	15	8
S2	Manipulation	15	7
S3	Precision	10	5
S4	Articulation	10	5
S5	Naturalization	--	--
<b>Total Marks</b>		<b>50</b>	<b>25</b>

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											2	1	
CO 2	1	2	3										2	1	
CO 3	1	2	3		1								2	1	



Approved in XXV<sup>th</sup> Academic Council  
Dated: 18<sup>th</sup> April 2023

MC1108 : Lab Data Base Management System		
Teaching Scheme	Examination Scheme	
Practical : 04 Hrs/Week	ISE I*	50 Marks
Credits : 02	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand the scope of SQL and use it to query, update and manage a database
- CO 2 Demonstrate advanced programming and functional features of SQL.
- CO 3 Create database connectivity for management of the database.

### Course Contents (Indicative List of Experiments not restricted to)

- 1 To execute all the Basic DDL (Data Definition language) commands (i.e. Create, Alter Drop, and Truncate) with example
- 2 To execute all the Basic DML (Data Manipulation language) commands (i.e. Insert, Select, Update, and Delete) with example
- 3 To Execute the Database Functions (i.e. Numeric, Date, Group, Character, and count function) with example
- 4 To Execute the join Commands (i.e. Cartesian product, natural join, Inner join, left outer join, right outer join, equi-join, non- equi-join, and full-join).
- 5 Implement the Program for Arithmetic operations (like addition, Subtraction, Multiplication and Division) using PL/SQL (programming language in SQL)
- 6 Implement the concept for cursors in PL/SQL and demonstrate competence for loop constructs.
- 7 To implement the program for updating the values using cursor
- 8 To implement the Concept of Views and SQL Sub-Queries

### Assessment:

Practical Examination will consist of Performance and Viva-voice Examination. The assessment will be based on the following–

1. Performance in the practical examination.
2. Record of programs submitted by the candidate.

### Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	15	8
S2	Manipulation	15	7
S3	Precision	10	5
S4	Articulation	10	5
S5	Naturalization	--	--
<b>Total Marks</b>		<b>50</b>	<b>25</b>



**Mapping of COs and Pos**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	<b>1</b>	<b>2</b>	<b>1</b>										<b>2</b>	<b>1</b>	
CO 2	<b>1</b>	<b>2</b>	<b>3</b>										<b>2</b>	<b>1</b>	
CO 3	<b>1</b>	<b>2</b>	<b>3</b>										<b>2</b>	<b>1</b>	



Approved in XXV<sup>th</sup> Academic Council  
Dated: 18<sup>th</sup> April 2023

MC1109 : Lab Communication Skills		
Teaching Scheme	Examination Scheme	
Practical : 02 Hrs/Week	ISE I*	25 Marks
Credits : 01	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand the various aspects of communication.
- CO 2 Apply the grammatical constructs for establishment of various communications.
- CO 3 Demonstrate competence in oral, written, and visual communication.

#### Course Contents (Indicative List of Experiments not restricted to)

1. Different Communication Situation. (Formal, Informal, Upward, Downward . etc)  
Telephonic Communication. (Enquiry, Leaving Message etc.)
2. JAM Sessions Group Discussion. Debate. Presentation Interview
3. Practical Based on the following Points:
  - a. Parts of Speech,
  - b. Types of Tense,
  - c. Use of Articles,
  - d. Synonyms and Antonyms,
4. Find out the Grammatical Errors in the given sentences
5. Practical Based on the following Points
  - a. Letter Writing,
  - b. Office documents like, Notices, Minutes, Agenda
  - c. Report Writings.
  - d. Resume Writing
6. Email Writing,
7. Listen to the Audio and Answer the Questions
8. Analyze the Data and answer The questions

#### Assessment :

Practical Examination will consist of Performance and Viva-voice Examination.

#### Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	10	10
S2	Manipulation	05	05
S3	Precision	05	05
S4	Articulation	05	05
S5	Naturalization	--	--
<b>Total Marks</b>		<b>25</b>	<b>25</b>

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	O 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	<b>1</b>	<b>1</b>								<b>1</b>			<b>1</b>		
CO 2	<b>1</b>	<b>1</b>								<b>2</b>			<b>1</b>		
CO 3	<b>1</b>	<b>1</b>								<b>2</b>			<b>1</b>		



Approved in XXV<sup>th</sup> Academic Council  
Dated: 18<sup>th</sup> April 2023

MC1111 : Object Oriented Programming with Java		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : 01 Hrs / week	ISE II*	20 Marks
Credits : 04	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand OOP concepts and Java programming environment.
- CO 2 Demonstrate the various programming constructs in Java programming language.
- CO 3 Create Java application programs using sound OOP practices.
- CO 4 Apply testing and debugging to discover errors.
- CO 5 Develop stand alone applications with GUI and database connectivity.

### Course Contents

Unit No	Detailed Contents
1	<b>Object Oriented Programming-</b> An overview of OOP concepts: Class, object, message passing, inheritance, encapsulation, polymorphism, Difference between OOP and other conventional programming, advantages and disadvantages. Importance of Java in the internet, Java applets and applications, security, portability, the byte code.
2	<b>Java Fundamentals -</b> Introduction to Java: History and evolution of Java, Java features, Java vs other popular languages, Java programming environment, Installing Java, Exploring the IDE, JVM, command line arguments,Bytecodes And The Java Virtual Machine, Application And Applets, The Java Class Libraries, The Java Development Kit (JDK), Identifiers, Keywords &Types-Variables And Assignments, Strings And Characters, Arithmetic Operators And Expressions, Type Conversion and Casting,The New Operator, Garbage Collection, Other Wrapper Classes, The String Buffer Class, Arrays Of Objects, Command Line Arguments
3	<b>Java Memory Model-</b> Objects and classes, declaring objects, constructors, The General Form Of A Class, Creating Simple Classes, Method Overloading, Adding Constructors, The This Keyword, Instance Variables And Methods, Static Variables And Methods, Local Variables And Variable Scope, Argument Passing, Introduction to Inner Classes Inheritance-Subclasses, Inheritance And Variables, Method Overriding, Inheritance And Methods,inheritance And Constructors, Class Modifiers, Variable Modifiers, Constructor Modifiers, Method Modifiers, Interface And Packages, Interfaces, Interface References, Interface Inheritance, The Instance Of Operator, Packages, Class-path, The Import Statement, Access Control And Packages,
4	<b>Multithreading, Exceptions handling, File handling -</b> Multithreading: Lifecycle of Thread, Thread Scheduler, Thread Priority, Daemon Thread, Exception Handling :Try Catch Multiple Catch, throw,Difference between final, finally and finalize, File Handling : Java I/O, stream, Output stream, Input stream, Data output stream, Data Input stream.

- 5 **GUI Programming** - An Overview Of Applets, Your First Java Applet, The Life Cycle Of An Applet, The Graphics Class, Using colour, Displaying Text, Using Applets In A Web Page Event Handling The Delegation Event Model, Event Classes, Event Listeners, Adapter Classes, Advance Language Features, Inner Classes, Anonymous Inner Classes, The Abstract Window Toolkit, Labels, Buttons, Canvases, Check Boxes, Choices, Text Fields And Text Areas, Lists, Scroll Bars, Grid Layout, Panels, Windows And Frames, Menus And Menu Bars, Overview Of JFC (Java Foundation Classes), Swings & AWT Component Hierarchy

**Tools Used** – JDK 1.4 / 1.5, Text Pad / Edit-Plus, java, javac, jar, javaw, javap

### Text Books

- 1 Programming with JAVA – E. Balgurusamy, 2nd Ed, TMH
- 2 Thinking in Java – Bruce Eckel - 3rd Edition Prentice-Hall
- 3 A Programmer's Guide to Java Certification – Khalid Mughal, Rolf Rasmussen

### Reference Books

- 1 Java 2 Complete Reference – Herbert Schildt and Patrick Naughton McGraw Hill
- 2 Java Swing, 2nd Edition by Dave Wood, Marc Loy, James Elliott, Brian Cole.
- 3 Core Java – Part 1 – Sun Microsystems Press

### E Books/ Online learning material

- 1 NPTEL - <https://nptel.ac.in/courses/106/105/106105191/>
- 2 SWAYAM- [https://swayam.gov.in/nd1\\_noc19\\_cs84/preview](https://swayam.gov.in/nd1_noc19_cs84/preview)
- 3 COURSERA-<https://www.coursera.org/courses?query=core%20java>

### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	2	
CO 2	1	2											1	2	
CO 3	1	2	3		2								1	2	
CO 4	1	2	1										1	1	
CO 5	1	2	3		2									2	

### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	10	10	-	-	-
ISE II* 20 Marks	5	5	-	5	5
ESE Assessment 60 Marks	6	12	18	12	12

**Assessment Pattern:**

<b>Level No.</b>	<b>Knowledge Level</b>	<b>ISE I*</b>	<b>ISE II*</b>	<b>End Semester Examination</b>
K1	Remember	10	5	15
K2	Understand	10	5	15
K3	Apply	-	-	6
K4	Analyze	-	5	-
K5	Evaluate	-	5	12
K6	Create	-	-	12
<b>Total</b>		20	20	20



Approved in XXV<sup>th</sup> Academic Council  
Dated: 18<sup>th</sup> April 2023

MC1112 : Internet of Things(IoT)		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : --	ISE II*	20 Marks
Credits : 03	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand basic concepts of IoT & it's different components.
- CO 2 Analyze different network prototypes for different Sensor connections.
- CO 3 Apply Python programming with Raspbian OS.
- CO 4 Design applications for File handling, data logging and database handling using RPi with Python
- CO 5 Develop IoT based projects.

### Course Contents

Unit No	Detailed Contents
1	<p><b>Introduction to IoT:</b> What is IoT, Features of IoT, Applications of IoT, Challenges in IoT</p> <p><b>IoT Components:</b> Raspberry Pi, Arduino, different Sensors, Actuators, Connectors.</p>
2	<p><b>Basics of IoT Networking protocols:</b> Raspbian OS, Networking Protocols, Bluetooth, WSN, Sensor Web.</p> <p><b>Connections with IoT components:</b> Connections with different Sensors ( ultrasonic, temperature, vibration), Actuators, output devices (LED, Screen, Buzzer)</p>
3	<p><b>Python Programming with RPi:</b> Basics of python programming, Python sensor libraries, python with Raspbian OS, Read data from Sensor, store data to Server, data logging using python.</p>
4	<p><b>Network Programming in IoT:</b> Server connections, Database Handling, Runtime Data upload to Server, File Read-Write operations.</p>
5	<p><b>Case Study :</b></p> <ol style="list-style-type: none"> <li>1) Smart Cities and Homes with IoT</li> <li>2) Connected Vehicles</li> </ol>

### Text Books

- 1 Getting Started with the Internet of Things, By CunoPfister
- 2 IoT fundamentals , Author: David Hanes, Gonzalo Sanguero

### Reference Books

- 1 Internet of Things: A Hands-On Approach By Arshdeep Bahga, Vijay Madiseti
- 2 Internet of Things with Raspberry Pi 3: By Maneesh Rao.
- 3 Raspberry Pi IoT Projects: Prototyping Experiments for Makers,By John C. Shovic,,

**E Books/ Online learning material**

- 1 NPTEL online course: Introduction to Internet of Things, By IIT Kharagpur  
[https://onlinecourses.nptel.ac.in/noc22\\_cs53/preview](https://onlinecourses.nptel.ac.in/noc22_cs53/preview)

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	1	
CO 2	1	2											1	1	
CO 3	1	2	3		2								1	2	
CO 4	1	2	3		2								1	2	
CO 5	1	2	3		2								1	2	

**Assessment Table:**

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	10	10	-	-	-
ISE II* 20 Marks	-	5	5	5	5
ESE Assessment 60 Marks	18	18	12	12	-

**Assessment Pattern:**

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	10	5	15
K2	Understand	10	5	15
K3	Apply	-	-	6
K4	Analyze	-	5	-
K5	Evaluate	-	5	12
K6	Create	-	-	12
<b>Total</b>		20	20	60



MC1113 : Python Programming		
Teaching Scheme	Examination Scheme	
Lectures: 03 Hrs / week	ISE I*	20 Marks
Tutorial: 01 Hrs / week	ISE II*	20 Marks
Credits: 04	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand the basic structure of python application development.
- CO 2 Understand different data constructs in python like lists, tuples, sets & dictionaries.
- CO 3 Analyse various control structures, methods and exception handling concepts in python.
- CO 4 Design and development of applications using python classes.
- CO 5 Develop a python application using database connectivity.

### Course Contents

Unit No	Detailed Contents
1	<b>Introduction:</b> Introduction to python, identifiers, variables, indentation in python, input and output functions, operators, data types – numbers, strings, list, tuple, set, dictionary, data type conversion.
2	<b>Conditional and control statements:</b> Decision making, loops, nested loops, control statements – break, continue, pass, operations on data types.
3	<b>Functions -</b> Function definition, function calling, function arguments – required, keyword, default, variable length, Anonymous functions, recursive functions
4	<b>Modules and packages</b> – built in modules, creating modules, import statement, packages in python, importing modules from package. <b>Object oriented programming</b> – class definition, creating objects, built in attribute methods and class methods, inheritance, operator overloading.
5	<b>Exception handling</b> – built in exceptions, handling exceptions, raising an exception, user defined exceptions, assertions in python. <b>File Handling</b> – opening a file, closing a file, writing to a file, reading from a file, file methods. <b>Data base programming</b> – connecting to data base, creating tables, operations on tables, exception handling in data base.

### Text Books

- 1 Taming python by programming, Dr. Jeeva Jose, Khanna Publishing, 2018

### Reference Books

- 1 Python Crash Course, Eric Matthes (No Starch Press, 2016)
- 2 Learn Python 3 the Hard Way, Zed A. Shaw (Addison-Wesley, 2016)
- 3 Think Python First Edition, by Allen B. Downey, Green Tea Press
- 4 Python - The Complete Reference by Martin C. Brown, McGraw Hill Education; Forth edition



**E Books/ Online learning material**

- 1 <https://nptel.ac.in/courses/106/106/106106182/>
- 2 [https://swayam.gov.in/nd1\\_noc19\\_cs41/preview](https://swayam.gov.in/nd1_noc19_cs41/preview)
- 3 <https://docs.python.org/3/tutorial/>
- 4 <http://www.codecademy.com/tracks/python>
- 5 <http://corepython.com/>
- 6 [http://www.python-course.eu/python3\\_course.php](http://www.python-course.eu/python3_course.php)

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	1	
CO 2	1	2											1	1	
CO 3	1	2	3		2								1	2	
CO 4	1	2	3		2								1	2	
CO 5	1	2	3		2								1	2	

**Assessment Table:**

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	10	5	-	-
ISE II* 20 Marks	-	5	5	5	5
ESE Assessment 60 Marks	12	12	18	12	6

**Assessment Pattern:**

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	5	5	12
K2	Understand	5	5	24
K3	Apply	10	-	24
K4	Analyze	-	5	-
K5	Evaluate	-	5	-
K6	Create	-	-	-
<b>Total</b>		<b>20</b>	<b>20</b>	<b>60</b>

MC1114 : Information Security		
Teaching Scheme	Examination Scheme	
Lectures : 04 Hrs / week	ISE I*	20 Marks
Tutorial : --	ISE II*	20 Marks
Credits : 04	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand the concepts of information security and its importance
- CO 2 Understand authentication requirement and study various authentication mechanisms.
- CO 3 Evaluate mathematical background on cryptographic functions.
- CO 4 Identify stream cipher and block cipher algorithms and functionalities.
- CO 5 Assess the existing network security related issues.

### Course Contents

Unit No	Detailed Contents
1	<b>Information Security:</b> Introduction to information hiding, information hiding in noisy data, a survey of steganography techniques, watermarking
2	<b>Network Security Practice:</b> Authentication Application – Electronic Mail Security – IP Security Program Security and System Security: Secure programs – No malicious program errors – viruses and Worms – Memory and address protection – control access to general objects – File protection mechanism – user authentication – Trusted operating system design and assurance – Intrusion Detection system
3	<b>Symmetric Encryption and Message Confidentiality :</b> Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers , Stream Ciphers and RC4, Cipher Block Modes of Operation, Recommended Reading and Web Sites, Key Terms, Review Questions, and Problems
4	<b>Public-Key Cryptography and Message Authentication :</b> Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Recommended Reading and Web Sites, Key Terms, Review Questions, and Problems
5	<b>Biometrics security:</b> Biometric identification, verification, authentication, different biometric techniques, biometric design steps, biometric template, and biometric template security.

### Text Books

- 1 Information Security and cyber laws, Saurabh Sharma, student series, Vikas publication
- 2 Security in Computing, Shari Lawrence Pfleegner, Prentice Hall of India, 2007.

**Reference Books**

- 1 Information Security The Complete Reference by Mark Rhodes-Ousley, 2nd Edition
- 2 Network Security: The Complete Reference by Keith Strassberg, Mark Rhodes-Ousley, and Roberta Bragg.
- 3 Cryptography and Network Security by William Stallings, 5th Edition, Pearson.
- 4 Wireless Operational Security by John W. Rittinghouse, James F. Ransome, Elsevier, 2004.
- 5 Implementing Database Security and Auditing by Ron Ben Natan, Elsevier, 2005.
- 6 Web Security by Lincoln D. Stein, Addison Wesley, 1999.

**E Books/ Online learning material**

- 1 NPTEL - <https://nptel.ac.in/courses/106/106/106106129/>
- 2 YouTube IS Tutorials - <https://bit.ly/3jAmS7k>

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	1	
CO 2	1	2											1	1	
CO 3	1	2											1	1	
CO 4	1	2											1	1	
CO 5	1	2											1	2	

**Assessment Table:**

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	10	10	-	-	-
ISE II* 20 Marks	5	5	5	5	-
ESE Assessment 60 Marks	18	18	12	12	-

**Assessment Pattern:**

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	10	5	24
K2	Understand	10	5	24
K3	Apply	-	-	12
K4	Analyze	-	5	-
K5	Evaluate	-	5	-
K6	Create	-	-	-
<b>Total</b>		20	20	60

MC1115 : Data Science		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : --	ISE II*	20 Marks
Credits: 03	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand the concepts of Data Science and challenges in Data Science.
- CO 2 Understand the concepts R programming.
- CO 3 Understanding of data visualization, data wrangling.
- CO 4 Understand statistical concepts in dealing with data.
- CO 5 Apply appropriate tools and techniques for learning through real world case studies.

### Course Contents

Unit No

Detailed Contents

- 1 **Introduction:**  
What Is Data Science? Where Do We See Data Science? How Does Data Science Relate to Other Fields? The Relationship between Data Science and Information Science, Computational Thinking, Skills for Data Science, Tools for Data Science, Issues of [Ethics, Bias, and Privacy in Data Science]
- 2 **Data:**  
Introduction, Types of Data, Structured Data, Unstructured Data, Challenges with Unstructured Data, Data Collection, Data Pre-processing, Data Cleaning, Data Integration, Data Transformation, Data Reduction, Data Discretization.
- 3 **Techniques:**  
Data Analysis and Data Analytics, Descriptive Analysis, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Exploratory Analysis, Mechanistic Analysis.
- 4 **Tools for Data Science:**  
Introduction to R, Getting Access to R, Getting Started with R, R Basics, Control Structures, Functions, Importing Data, Graphics and Data Visualization, Installing ggplot, Loading the Data, Plotting the Data, Statistics and Machine Learning, Basic Statistics, Regression, Classification, Clustering.
- 5 **Applications, Evaluations, and Methods**  
**Data Collection Methods:** Introduction to Quantitative and Qualitative Methods  
**Evaluation:** Comparing Models, Training–Testing and A/B Testing, Cross-Validation  
**Hands-On with Solving Data Problems:** Collecting and Analyzing Twitter / YouTube Data

### Text Books

- 1 A Hands-On Introduction to Data Science by Chirag Shah, Second Edition, Cambridge Press.

- 2 Introduction to Data Science by Rafael A. Irizarry, Harvard CRC Press

### Reference Books

- 1 The Data Science Handbook: Advice and Insights from 25 Amazing Data Scientists, Carl Shan, William Chen, Data Science Bookshelf.
- 2 Data Science (The MIT Press Essential Knowledge series), John D. Kelleher and Brendan Tierney, Part of: The MIT Press Essential Knowledge series.
- 3 Foundations of Data Science 1st Edition, Avrim Blum, John Hopcroft, Ravindran Kannan Cambridge University Press.

### E Books/ Online learning material

- 1 Data Science for Engineers [https://swayam.gov.in/nd1\\_noc19\\_cs60/preview](https://swayam.gov.in/nd1_noc19_cs60/preview)

### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	1	
CO 2	1	2	3		2								1	1	
CO 3	1	2	1										1	1	
CO 4	1	2	1										1	1	
CO 5	1	2	1										1	1	

### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	10	-	5	-
ISE II* 20 Marks	-	-	5	10	5
ESE Assessment 60 Marks	18	18	12	12	-

### Assessment Pattern:

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	5	-	18
K2	Understand	10	5	24
K3	Apply	5	10	18
K4	Analyze	-	5	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60

<b>MC1116 : Soft Computing</b>		
<b>Teaching Scheme</b>	<b>Examination Scheme</b>	
<b>Lectures: 03 Hrs / week</b>	<b>ISE I*</b>	<b>20 Marks</b>
<b>Tutorial: --</b>	<b>ISE II*</b>	<b>20 Marks</b>
<b>Credits: 03</b>	<b>End Semester Examination</b>	<b>60 Marks</b>

**Course Outcomes-** After studying this course, students will be able to:

- 1 Understand the basic concepts of ANN
- 2 Understand different ANN training algorithms
- 3 Understand Fuzzy logic concepts and apply it for simple applications
- 4 Design ANN using supervised and unsupervised learning algorithms
- 5 Apply ANN and fuzzy logic for application development.

### **Course Contents**

Unit No

Detailed Contents

- 1 Introduction to ANN, Basic terminology, Biological neurons and its working, Simulation of biological neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real life problems.
- 2 Pattern recognition and data classification, neuron signal functions, Non-linearly separable problems, XOR problem, perceptron learning algorithm
- 3 Multilayer network, Back propagation algorithm, function approximation and NN, applications of FFNN, learning from examples and generalization, radial basis function network
- 4 Self organization, competitive learning, vector quantization, Mexican hat networks, self organizing feature map, applications of self organizing feature map
- 5 Fuzzy sets and fuzzy systems, need for numeric and linguistic processing, fuzzy uncertainty and the linguistic variable, fuzzy sets, membership functions, simple operations on fuzzy sets, fuzzy rules, applications

### **Text Books**

- 1 Neural Network – A classroom approach by Satish Kumar, Tata McGraw hill
- 2 Fuzzy logic by F. Martin McMeill, Academic Press Inc;

### **Reference Books**

- 1 Artificial Neural Network, Yagnanarayana
- 2 Soft Computing techniques, N.P. Padhy , S.P. Simon, Oxford University Press
- 3 Soft Computing: Neural Networks, Fuzzy Logic and Genetic Algorithms, Sushil Kumar Singh, Galgotia Publications (P) Ltd

**E Books/ Online learning material**

- 1 [https://swayam.gov.in/nd1\\_noc20\\_cs17/preview](https://swayam.gov.in/nd1_noc20_cs17/preview)
- 2 [www.mathworks.com](http://www.mathworks.com)

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	1	
CO 2	1	2	3		2								1	1	
CO 3	1	2	1										1	1	
CO 4	1	2	1										1	1	
CO 5	1	2	1										1	1	

**Assessment Table:**

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	10	5	-	-
ISE II* 20 Marks	-	5	5	5	5
ESE Assessment 60 Marks	12	18	12	18	-

**Assessment Pattern:**

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	05	-	12
K2	Understand	10	5	24
K3	Apply	5	5	24
K4	Analyze	-	5	-
K5	Evaluate	-	5	-
K6	Create	-	-	-
<b>Total</b>		20	20	60



MC1117 : Big Data Analytics		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : --	ISE II*	20 Marks
Credits : 03	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand the concepts of Big data and challenges in processing Big Data.
- CO 2 Understand Hadoop architecture and eco-system.
- CO 3 Understanding of Hadoop Distributed File System.
- CO 4 Understand the concepts of map and reduce and functional programming.
- CO 5 Identify appropriate techniques and tools to solve actual Big Data problems.

### Course Contents

Unit No	Detailed Contents
1	<p><b>Introduction to Big Data and Hadoop:</b> What is Big Data, What are Challenges in processing Big data? What is Hadoop, Data Storage and Analysis, Comparison with Other Systems: RDBMS, Grid Computing, Volunteer Computing; A Brief History of HADOOP, Apache HADOOP and the HADOOP Eco-system.</p>
2	<p><b>HDFS: Hadoop Distributed File System:</b> Significance of HDFS in Hadoop, Features of HDFS, The Design of HDFS, HDFS Concepts: Blocks, Data replication, Name nodes and Data nodes; Accessing HDFS: CLI (Command line interface), Java based Approach.</p>
3	<p><b>Map Reduce:</b> Map Reduce Architecture, How map reduce works: Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion. Failures, Job Scheduling.</p>
4	<p><b>Pig:</b> Introduction to Apache Pig, Map-Reduce vs Pig, Pig Latin, Data Processing Operators. <b>Hive:</b> Hive introduction, Architecture, Comparison with Traditional Databases, Hive QL, and Tables.</p>
5	<p><b>HBase:</b> HBase Basics Concepts, HBase Versus RDBMS. <b>ZooKeeper:</b> The ZooKeeper Service. <b>Case Studies:</b> Hadoop and Hive at Facebook, Log Processing at Rackspace.</p>

### Text Books

- 1 Hadoop: The Definitive Guide by Tom White, Second Edition, O'Reilly Yahoo Press.
- 2 Hadoop for Dummies by Robert D. Schneider, Willey.



### Reference Books

- 1 Big Data Analytics with R and Hadoop by Vignesh Prajapati, Packt Publishing.
- 2 Big Data Analytics by Radha Shankarmani, M. Vijayalakshmi, Wiley
- 3 Big Data and Analytics by Subhashini Chellappan Seema Acharya, Wiley
- 4 Big Data Analytics Kindle Edition by Parag Kulkarni, Sarang Joshi, Meta S. Brown, PHI Learning.

### E Books/ Online learning material

- 1 <http://planetbigdata.com/>
- 2 Big Data Computing [https://swayam.gov.in/nd1\\_noc20\\_cs92/preview](https://swayam.gov.in/nd1_noc20_cs92/preview)

### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	1	
CO 2	1	2	3		2								1	1	
CO 3	1	2	1										1	1	
CO 4	1	2	1										1	1	
CO 5	1	2	1										1	1	

### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	10	5	-	-
ISE II* 20 Marks	-	5	5	5	5
ESE Assessment 60 Marks	12	18	12	18	-

### Assessment Pattern:

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	05	-	12
K2	Understand	10	5	30
K3	Apply	5	5	18
K4	Analyze	-	5	-
K5	Evaluate	-	5	-
K6	Create	-	-	-
<b>Total</b>		<b>20</b>	<b>20</b>	<b>60</b>

MC1118 : Lab. Object Oriented Programming with Java		
Teaching Scheme	Examination Scheme	
Practical : 04 Hrs/Week	ISE I*	50 Marks
Credits : 02	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand object oriented concepts like classes, objects, inheritance, polymorphism resembling real time situation.
- CO 2 Understanding Java development Environment such as Eclipse, NetBeans etc.
- CO 3 Create JAVA programs based on simple constructs like arrays, loops , decision statements, functions etc

### Course Contents (Indicative List of Experiments not restricted to)

1. Write a java program to demonstrate all the basic programming features such as if else condition, loops, switch case, break and continue statement, variables, data types and operators.
2. Write a java program to demonstrate
  - a. Fibonacci series
  - b. Factorial of a number
  - c. Prime number
  - d. Armstrong number
  - e. Reverse number
  - f. Palindrome number
3. Write a program in java to demonstrate typecasting concept on various primitive data type.
4. Write a java program to demonstrate the use of wrapper classes and its methods (3 methods).
5. Write a java program to accept 1 to 10 numbers and print their sum using command line arguments.
6. Write a java program for accepting 10 integer numbers and sort them in ascending order using bubble sort.
7. Write a java program to demonstrate two-dimensional array (matrix) by finding an addition of two 3\*3 matrices.
8. Write a java program to demonstrate two-dimensional array (matrix) by finding multiplication of two 3\*3 matrices.
9. Write a java program to demonstrate methods of string class and their use with example.
10. Write a java program to demonstrate various constructors in a single program.
11. Write a java program to demonstrate single inheritance.
12. Write a java program to demonstrate multilevel inheritance.
13. Write a java program to demonstrate multiple inheritance achieved using interface.
14. Write a java program to explain static and non-static inner classes.
15. Write a java program to demonstrate abstract class and abstract methods.
16. Write a java program for accepting user defined package and access the classes of these packages in other program.
17. Write a java program to demonstrate use of threads by:
  - a) by implementing runnable interface
  - b) by extending thread class
18. Write a java program to demonstrate suspend(), resume(), stop() methods of a thread.
19. Write a java program to demonstrate sleep(), wait(), notify(), yield(), notifyAll() method of thread.



20. Write a java program to demonstrate thread priorities.
21. Write a java program to demonstrate the concept of daemon thread.
22. Write a java program to illustrate thread synchronization.
23. Write a java program to demonstrate exception handling mechanism
  - a) Default throw and our catch
  - b) Our throw and our catch
24. Write a java program for accepting user input through applet.
25. Create a java applet to demonstrate the various mouse event handlers.
26. Create a java applet to demonstrate the various keyboard event handlers.
27. Write a program to create I/O file operations
28. Create a java applet to demonstrate various graphics methods.

**Assessment:**

Practical Examination will consist of Performance and Viva-voice Examination.

The assessment will be based on the following–

1. Performance in the practical examination.
2. Record of programs submitted by the candidate.

**Assessment Pattern:**

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	15	08
S2	Manipulation	15	07
S3	Precision	10	05
S4	Articulation	10	05
S5	Naturalization	-	-
<b>Total Marks</b>		<b>50</b>	<b>25</b>

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	2	
CO 2	1	2											1	2	
CO 3	1	3	3						2				1	3	

MC1119 : Lab Internet of Things (IoT)		
Teaching Scheme	Examination Scheme	
Practical : 2Hrs/Week	ISE I*	25 Marks
Credits : 01	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understanding basic building blocks for creating an IoT system.
- CO 2 Understanding files, database and cloud data logging with IoT.
- CO 3 Create python programs with RPi to work with different sensors.

### Course Contents (Indicative List of Experiments not restricted to)

- 1 Study Raspberry Pi and Raspbian OS.
- 2 Study of different Sensors , Actuators, Connectors, LED with RPi
- 3 Write Python program in RPi to Glow LED with specific time interval.
- 4 Write Python program in RPi to Glow LED if Buzzer sound.
- 5 Create IoT circuit with python program to maintain Temperature data log.
- 6 Database connection with IoT using Raspberry Pi
- 7 File read/Write operations with IoT using Raspberry Pi
- 8 Using IoT system, send runtime data log to the cloud.
- 9 Case Study : Smart City or Smart Vehicle
- 10 Mini Project

### Assessment:

Practical Examination will consist of Performance and Viva-voice Examination. The assessment will be based on the following–

1. Performance in the practical examination.
2. Record of programs submitted by the candidate.

### Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I*	End Semester Examination
S1	Imitation	08	08
S2	Manipulation	07	07
S3	Precision	05	05
S4	Articulation	05	05
S5	Naturalization	--	--
<b>Total Marks</b>		<b>25</b>	<b>25</b>

### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	2	
CO 2	1	2											1	2	
CO 3	1	3	3						2				1	3	

MC1120 : Lab Python Programming		
Teaching Scheme	Examination Scheme	
Practical : 4Hrs/Week	ISE I*	50 Marks
Credits : 02	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able to:

- CO 1 Understand the basic concepts of scripting.
- CO 2 Explore the object oriented concepts of Python programming language.
- CO 3 Create python programs using files and databases.

**Course Contents (Indicative List of Experiments not restricted to)**

1. Program to find largest and smallest of three integer numbers without using decision making statements
2. Program to swap values of two variables using bitwise operator
3. Program to print non prime numbers from the given range using for loop
4. Program to add digits of a number using while loop
5. Program to Search whether all characters in one string are available into another string
6. Program for Result Processing using nested list
7. Program for Result Processing using dictionary
8. Write a program to convert words into numbers using dictionary and list.
9. Program to count digits of number using function
10. Program to check whether the given number is palindrome by passing function name as an argument to another function
11. Program to demonstrate use of lambda function with map and reduce functions.
12. Program to demonstrate calling function from another file
13. Program to demonstrate creating and importing a package
14. Program to demonstrate hierarchical inheritance
15. Program to demonstrate binary operator overloading
16. Write a program to demonstrate exception handling using raise, try, except and finally statements.
17. Create a list of 10 elements. Write a program to write this list in binary file and then read it back to find out the smallest and largest value.
18. Write a function in Python to count and display the total number of words in a text file.
19. Write a Python program to create a table and insert some records in that table. Then selects all rows from the table and display the records.

**Assessment :**

Practical Examination will consist of Performance and Viva-voice Examination. The assessment will be based on the following–

1. Performance in the practical examination.
2. Record of programs submitted by the candidate.



**Assessment Pattern:**

Assessment Pattern Level No.	Knowledge Level	ISE I*	End Semester Examination
S1	Imitation	15	08
S2	Manipulation	15	07
S3	Precision	10	05
S4	Articulation	10	05
S5	Naturalization	-	-
<b>Total Marks</b>		<b>50</b>	<b>25</b>

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2											1	1	
CO 2	1	2	2										1	3	
CO 3	1	3	3						2				1	3	



Approved in XXV<sup>th</sup> Academic Council  
Dated: 18<sup>th</sup> April 2023

MC1121 : Seminar		
Teaching Scheme	Examination Scheme	
Practical : 2Hrs/Week	ISE I*	50 Marks
Credits : 01	End Semester Evaluation	--

**Course Outcomes-** After studying this course, students will be able:

- CO 1 Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
- CO 2 Demonstrate effective writing skills and processes by employing the rhetorical techniques of academic writing, including invention, research, critical analysis and evaluation, and revision.
- CO 3 Incorporate and document appropriate sources in accordance with the formatting style proper for the discipline and effectively utilize the conventions of standard written English.

### Course Contents

The aim of the seminar is to make the students study something extra other than curriculum. They are expected to go through the latest trend pertaining to computer and allied fields and deliver the seminar by preparing report.

The other important aim of the seminar is to encourage and develop the personality, aptitude and knowledge of the students.

### Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I*	End Semester Examination
S1	Imitation	15	--
S2	Manipulation	10	--
S3	Precision	--	--
S4	Articulation	10	--
S5	Naturalization	15	--
<b>Total Marks</b>		<b>50</b>	--

### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2		1		1		1		3	1	1	1	1	
CO 2	1	2		1		1		1		3	1	1	1	1	
CO 3	1	2		2		1		1		3	1	1	1	1	



**GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD**  
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**Scheme & Syllabus of  
Master of Computer Applications  
(MCA)  
2 Years Batch 2020 onwards  
(w.e.f. Academic Year 2022-23)**

**SYMCA  
Semester-III and Semester-IV**

**By  
Departmental Board of Study  
(Master of Computer Applications)  
Department of Master of Computer Application  
Government College of Engineering, Aurangabad**

MC2101 : Adv. Java		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : 01 Hrs / week	ISE II*	20 Marks
Credits : 04	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to

- CO 1 Understand RMI, Servlets, and MVC Architecture.
- CO 2 Understand architecture of Hibernate, ORM, Struts and Spring
- CO 3 Create web application using Java Servlet and Java Server Pages technology.
- CO 4 Design the application using advanced environment with Hibernate, Struct & Spring
- CO 5 Develop a mini project using layered MVC Architecture

### Course Contents

Unit No	Detailed Contents
1	<p><b>Introduction to Networking and RMI</b>  Basics Of Networking, Overview Of The OSI Model, Socket Programming, Client Sockets And Server Socket, Multicast Sockets  <b>RMI:</b> Introduction To Distributed Computing, RPC, Introduction To RMI, Stubs And Skeletons, The Process Of Creating A Simple RMI Application</p>
2	<p><b>Servlets</b> Introduction To Web Application Development, Introduction of a 2 &amp; 3 Tier Architecture, Server Side Programming, Introduction To Servlets, Comparing Servlets With CGI, Servlet Lifecycle, Servlet With Html, Server Side Includes, Servlet Chaining, HTTP Tunnelling, Session Management, Servlets With JDBC, Inter Servlet Communication, Deployment Descriptor ( web.XML ), Servlet Context &amp; Config Objects, Event Handling in Servlet, Jasper Report generation &amp; Calling Using Servlet.</p>
3	<p><b>Java Server Page and MVC Architecture</b>  Introduction, Difference between Servlet &amp; JSP ,Basic Tags (Scriptlet, expression, directives ,declaration), Basic Objects (out, session, request, application), Action tags(forward, include etc.), Java Server Tag Library  <b>Introduction to MVC,</b> Role of MVC in Servlet and JSP architecture.</p>
4	<p><b>Hibernate, Struts and Spring</b>  Introduction, difference between hibernate &amp; JDBC, Architecture of hibernate &amp; ORM understanding, Steps to configure hibernate &amp; create sample program, Introduction to HQL &amp; work with database  <b>Struct:</b> Introduction &amp; History, Struts with Hibernate, Struts with Spring, Struts with JDBC,  <b>Spring</b> :Spring Core Module, Spring J2EE module, Spring ORM, Spring JDBC, Spring AOP(Aspect Oriented Module),Spring Web MVC module</p>
5	<p><b>Maven project and Web services</b>  <b>Maven</b> :What is Maven, ANT Vs Maven, Install Maven, Maven Repository, Local Repository, Central Repository, Remote Repository, Maven Pom.xml, Maven Example, Maven Web App, Maven Plug-in <b>Web service</b> :WS Components, SOAP Web Service, RESTful Web Service, SOAP vs. RESTSOA, Java Web Services</p>

**J-unit Testing:** Types of Junit Testing, Assert Classes

**JAXB :** What is JAXB, features of JAXB, Object to XML, XML to Object

### Text Books

- 1 Java Programming: A practical approach by C. Xavier, McGraw Hill India Education 2011.
- 2 The Complete Reference – Java 2, 8<sup>th</sup> Edition by Herbert Schildt, Tata McGraw Hill, 2011.

### Reference Books

- 1 Programming With Java – A Primer, E. Balagurusamy, 4th Edition, Tata McGraw-Hill, 2010
- 2 Core Java Part 2 Advanced Features – Sun Microsystems press
- 3 J2EE™ Tutorial, 2nd Edition By Eric Armstrong, Jennifer Ball, Stephanie Bodoff, Stephanie Bodoff, Stephanie Bodoff, Debbie Carson, Ian Evans, Dale Green, Kim Haase, Eric Jendrock. Published by Addison Wesley
- 4 Java Design Patterns: A Tutorial by James W. Cooper Addison Wesley Pearson Press
- 5 Struts in Action by Ted Husted, Manning Publications Company.

### E Books/ Online learning material

- 1 <https://www.edureka.co/blog/advanced-java-tutorial>
- 2 <https://www.w3schools.in/java-tutorial/>
- 3 <https://nptel.ac.in/courses/106/105/106105191/>

### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	3												1	
CO 2	1	3													
CO 3	1	3	2		1								1		
CO 4	1	3	2		1								1		
CO 5	1	3	2	2	2	1		1	1	1	1	1	2	2	1

### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	5	5	-	5
ISE II* 20 Marks	5	-	5	5	5
ESE Assessment 60 Marks	18	18	12	12	-

**Assessment Pattern:**

<b>Level No.</b>	<b>Knowledge Level</b>	<b>ISE I*</b>	<b>ISE II*</b>	<b>End Semester Examination</b>
K1	Remember	5	5	18
K2	Understand	10	5	24
K3	Apply	5	10	18
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60



Approved in XXV<sup>th</sup> Academic Council  
Dated: 18<sup>th</sup> April 2023

MC2102 : ASP.Net and C#		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : 01 Hrs / week	ISE II*	20 Marks
Credits : 04	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to

- CO 1 Understand the ASP.Net web application execution model.
- CO 2 Understand web application configuration and demonstrate the ability to manage basic configuration issues.
- CO 3 Design and develop client and server side web applications using services.
- CO 4 Create and use libraries in the application programs.
- CO 5 Develop a mini project using .Net technologies.

### Course Contents

Unit No	Detailed Contents
1	<p><b>Getting Started with .NET:</b> Introduction to .NET Framework and Visual Studio.NET, Kind of Applications that can be developed using Visual Studio.NET, Website v/s Web Application, Creating a new sample Web Project with Visual Studio</p> <p><b>Creating Presentation Layer:</b> Creating Front-End with the HTML &amp; CSS, Grid Layout v/s Liquid Layout, using Cascaded Style Sheets</p>
2	<p><b>Introduction to C#:</b> Working with Variables, Data Types, Data Type Conversion, Operators and Expressions, Creating Classes and Objects in C#, Using Namespaces, Arrays, Exception Handling in C#, Navigating amongst Web Pages, Event Handling</p> <p><b>Important Files and Folders in Web Application:</b> All System Folders, Web.Config, Global.asax, Building sites with Master Pages, Using User Controls</p>
3	<p><b>Building ASP.NET Pages:</b> Standard Controls, Validation Controls,</p> <p><b>State Management:</b> ASP.NET Page Life Cycle, Session Management, Managing Query String, View State in C#</p>
4	<p><b>Working with Data:</b> ADO.NET Architecture, Connected &amp; Disconnected Architectures, SQL Connection, SQL Command &amp; important Classes for operating database related operations (CRUD), Using Datasets&amp; Data Adapters</p> <p><b>Working with Data Controls:</b> Grid View, Repeater Control</p>
5	<p><b>AJAX:</b> Ajax Architecture, Script Manager, Update Panel, Ajax Control Toolkit</p> <p><b>Web Services:</b> Creating and Consuming Web Services</p> <p><b>Deploying ASP.NET Websites:</b> Installing and configuring website using IIS</p>

### Text Books

- 1 Professional ASP.NET MVC 5 (WROX) – Jon Galloway and Brad Wilson
- 2 ASP.NET 3.5 unleashed – Stephan Walther

### Reference Books

- 1 The Complete Reference ASP.NET – Tata McGraw Hill
- 2 The Complete Reference C#
- 3 ASP.NET Programming – Murach
- 4 Microsoft ASP.NET 4.0 Step by Step – George Shepherd, Microsoft Press

- 5 Mastering ASP.Net – BPB Publication
- 6 Programming ASP.NET CORE – Dino Esposito
- 7 C# in Depth – Jon Skeet

### E Books/ Online learning material

- 1 [https://www.tutorialspoint.com/asp.net\\_mvc/asp.net\\_mvc\\_useful\\_resources.html](https://www.tutorialspoint.com/asp.net_mvc/asp.net_mvc_useful_resources.html)
- 2 <https://www.w3schools.com/asp/default.ASP>

### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	3												1	
CO 2	1	3													
CO 3	1	3	2		1								1		
CO 4	1	3	2		1								1		
CO 5	1	3	2	2	2	1		1	1	1	1	1	2	2	1

### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test)20 Marks	5	5	5	5	
ISE II* 20 Marks	5		5	5	5
ESE Assessment 60 Marks	18	18	12	12	

### Assessment Pattern:

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	5	5	18
K2	Understand	5	5	24
K3	Apply	10	10	24
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60

MC2103 : Cloud Computing		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : 01 Hrs / week	ISE II*	20 Marks
Credits : 04	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to

- CO 1 Understanding cloud architecture, services and management.
- CO 2 Understanding virtualization, security and storage in cloud computing.
- CO 3 Learn the Concept of Cloud Infrastructure Model with respect to different service providers
- CO 4 Analyze different security issues and challenges in cloud computing.
- CO 5 Develop an application using cloud technology for realizing real life scenarios.

### Course Contents

Unit No	Detailed Contents
1	<p><b>Basics of Cloud Computing:</b>            Overview, Applications, Intranets and the Cloud. Your Organization and Cloud Computing- Benefits, Limitations, Security Concerns. Software as a Service (SaaS)- Understanding the Multitenant Nature of SaaS Solutions, Understanding SOA. Platform as a Service (PaaS)-IT Evolution Leading to the Cloud, Benefits of PaaS Solutions, Disadvantages of PaaS Solutions. Infrastructure as a Service (IaaS)- Understanding IaaS, Improving Performance through Load Balancing, System and Storage Redundancy, Utilizing Cloud-Based NAS Devices, Advantages, and Server Types.</p>
2	<p><b>Data Storage and Security in Cloud:</b>            Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: Data store and Simple DB, Cloud Storage-Overview, Cloud Storage Providers. Securing the Cloud- General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats.</p>
3	<p><b>Virtualization:</b>            Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Centre Automation. Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP), Syndication (Atom, Atom Publishing Protocol, and RSS), and Standard for Security.</p>
4	<p><b>Cloud Service Providers:</b>            Amazon Web Services-Elastic Compute Cloud (EC2), Simple Storage Service (S3), Simple Queue Service (SQS), Elastic Block Storage (EBS), Elastic Load Balancing (ELB), SimpleDB, Relational Database Service (RDS), Virtual Amazon Cloud, Google- AppEngine, Google Storage, Windows Azure, Rackspace Cloud</p>

- 5 **Cloud Applications:**  
Business and Consumer Applications- CRM & ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming, E-Commerce Applications, , Cloud for e-Governance, Scientific Applications- Healthcare, Biology, Geosciences etc.

**Future of Cloud Computing:**

How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing. Future Research Directions and Challenges in Cloud Computing, Case Studies.

**Text Books**

- 1 Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more by Dr. Kris Jamsa, Wiley Publications.
- 2 Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley Publication, 1st Edition

**Reference Books**

- 1 Cloud Computing Insight into New-Era Infrastructure, Dr. Kumar Saurabh, Wiley India Pvt. Ltd., 1st Edition
- 2 Cloud Computing: A Practical Approach, Anthony T. Velte, Tata McGraw Hill, 2009
- 3 Guide to Cloud Computing: Principals and Practices, Richard Hill, Laurie Hirsch, Peter Lake, Siavash Moshiri, Springer, 1st Edition
- 4 Enterprise Cloud Computing, Gautam Shroff, Cambridge, 1st Edition
- 5 Cloud Security and Privacy, Tim Mather, Subra K, Shahid L., Oreilly, 1st Edition
- 6 Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, McGraw Hill Publication, 1st Edition
- 7 Enterprise Cloud Computing Technology Architecture, Applications, Gautam Shrof, Cambridge University Press, ISBN: 9780511778476

**E Books/ Online learning material**

- 1 <http://nptel.ac.in/courses/106106129/28>
- 2 <https://cloudacademy.com/courses/>
- 3 <https://www.lynda.com/Cloud-Computing-training-tutorials/1385-0.html>
- 4 <http://scpd.stanford.edu/search/publicCourseSearchDetails.do?method=load&courseId=11815>





**Mapping of COs and Pos**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2													
CO 2	1	2													
CO 3	1	2													1
CO 4	1	2	3										2	1	
CO 5	1	2	3		2			1	1	1			2	1	

**Assessment Table:**

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5		5	5	5
ISE II* 20 Marks	5		5	5	5
ESE Assessment 60 Marks	12	12	12	6	18

**Assessment Pattern:**

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	5	5	24
K2	Understand	5	10	24
K3	Apply	10	5	12
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60

<b>MC2104 : Software Quality Assurance</b>		
<b>Teaching Scheme</b>	<b>Examination Scheme</b>	
<b>Lectures : 03 Hrs / week</b>	<b>ISE I*</b>	<b>20 Marks</b>
<b>Tutorial : --</b>	<b>ISE II*</b>	<b>20 Marks</b>
<b>Credits : 03</b>	<b>End Semester Examination</b>	<b>60 Marks</b>

**Course Outcomes-** After studying this course, students will be able

- CO 1 Understanding fundamental concepts of software quality assurance with respect to SDLC and PDLC.
- CO 2 Understanding different standards, certifications and assessments for SQA.
- CO 3 Apply the concepts in preparing the quality plan & documents.
- CO 4 Analyzing and estimating cost of a T&QA project, maintenance of project and manage budgets
- CO 5 Design and develop test cases for existing software projects.

### **Course Contents**

Unit No	Detailed Contents
1	<p><b>INTRODUCTION TO SOFTWARE QUALITY &amp; ARCHITECTURE</b>            Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.</p>
2	<p><b>SQA COMPONENTS AND PROJECT LIFE CYCLE</b>            Software Development methodologies – Quality assurance activities in the development process- Verification &amp; Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.</p>
3	<p><b>SOFTWARE QUALITY INFRASTRUCTURE</b>            Procedures and work instructions - Templates - Checklists – 3S development - Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit - Documentation control – Storage and retrieval.</p>
4	<p><b>SOFTWARE QUALITY MANAGEMENT &amp; METRICS</b>            Project process control, Computerized tools, Software quality metrics, Objectives of quality Measurement, Process metrics, Product metrics, Implementation, Limitations of software metrics, Cost of software quality, Classical quality cost model, Extended model, Application.</p>
5	<p><b>STANDARDS, CERTIFICATIONS &amp; ASSESSMENTS</b>            Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE 1012 &amp; 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.</p>

**Text Books**

- 1 Software Quality Assurance by Daniel Galin, Pearson Publication, 2009.
- 2 Effective Methods for Software Testing, Third edition by William E. Perry, Wiley India, 2009

**Reference Books**

- 1 Software Quality: Theory and Management by Alan C. Gillies, International Thomson Computer Press, 1997.
- 2 Software Testing and Quality Assurance Theory and Practice by Kshirsagar Naik, Priyadarshi Tripathy
- 3 Software Quality Engineering – Testing, Quality Assurance and Quantifiable Improvement, Jeff Tian, Wiley India, 2006.
- 4 Software Quality – A Practitioner’s approach, Kamna Malik, Praveen Choudhary, Tata McGraw-Hill, 2008.
- 5 Total Quality Management by Dale H. Besterfield, Prentice Hall, 2003.
- 6 Software Testing – Principles and Practices, Naresh Chauhan, Oxford University Press, 2010.
- 7 Software Quality Assurance, Milind Limaye, Tata McGraw-Hill, 2011.

**E Books/ Online learning material**

- 1 <https://www.udemy.com/course/introduction-to-software-testing-or-software-qa/>
- 2 <https://nptel.ac.in/courses/106/105/106105150/>
- 3 <https://nptel.ac.in/courses/106/101/106101061/>

**Mapping of COs and POs**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1														
CO 2	1														
CO 3	1	1													
CO 4	1	1	2		2						1		1	1	
CO 5	1	1	2		3			1	1		1		2	2	2

**Assessment Table:**

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	5	5	5	-
ISE II* 20 Marks	-	5	5	5	5
ESE Assessment 60 Marks	12	18	12	12	6

**Assessment Pattern:**

<b>Level No.</b>	<b>Knowledge Level</b>	<b>ISE I*</b>	<b>ISE II*</b>	<b>End Semester Examination</b>
K1	Remember	5	5	24
K2	Understand	5	5	24
K3	Apply	10	10	12
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60



<b>MC2105 : Enterprise Resource Planning</b>		
<b>Teaching Scheme</b>	<b>Examination Scheme</b>	
<b>Lectures : 03 Hrs / week</b>	<b>ISE I*</b>	<b>20 Marks</b>
<b>Tutorial : --</b>	<b>ISE II*</b>	<b>20 Marks</b>
<b>Credits : 03</b>	<b>End Semester Examination</b>	<b>60 Marks</b>

**Course Outcomes-** After studying this course, students will be able

- CO 1 Understanding the steps and activities in the ERP life cycle
- CO 2 Analyse the strategic options for ERP identification and adoption.
- CO 3 Design the ERP implementation strategies.
- CO 4 Create reengineered business processes for successful ERP implementation.
- CO 5 Obtain practical hands-on experience with one of the ERP Software.

### **Course Contents**

Unit No

Detailed Contents

- 1 **Introduction**  
What is ERP, Why ERP, Need for Enterprise Resource Planning, Definition of ERP, Evolution of Enterprise Resource Planning, Pre material requirement planning (MRP stage) Material requirement planning, MRP- II, ERP, Extended ERP, ERP Planning –II, ERP-A manufacturing perspective, Risks and benefits – ,Risk implementation, Fundamental technology of ERP Issues to be consider in planning design and, implementation of cross functional integrated ERP systems.
- 2 **ERP Solution and Functional Modules**  
Overview of ERP software solutions, Small, medium and large enterprise vendor solutions, Business process Reengineering, Business process Management, Steps of BPM, Functional Modules, ERP Production planning module, ERP purchasing module, ERP Inventory control module, ERP Sales module, ERP Marketing module, ERP Financial module, ERP HR module
- 3 **ERP Implementation**  
Planning Evaluation and selection of ERP systems, ERP Implementation life cycle, Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap-Analysis, Reengineering, Configuration  
Implementation Team Training, Testing, Going Live, End-user training, Post – implementation, ERP implementation, Methodology and Frame work, Training, Data Migration, People Organization in implementation, Consultants and Vendors, Employees.
- 4 **Post Implementation**  
ERP Implementation, Maintenance of ERP, Organizational and Industrial impact, Success factors of ERP Implementation, Key success factors, Failure factors of ERP Implementation.
- 5 **Emerging Trends on ERP**  
C Extended ERP systems and ERP add-ons, CRM, Benefits of ERP Module, Supply Chain Management (SCM), Business analytics & Intelligence, Wireless Technology used in ERP, Future trends in ERP, Cloud Computing, SAP and the Internet



**Text Books**

- 1 Enterprise Resource Planning – Alexis Leon – Second Edition – TMH
- 2 Enterprise resource planning, Vinod Kumar Garg, N. K. Venkita Krishna, 2nd Edition , PHI, 2003

**Reference Books**

- 1 ERP in practice – Vaman - TMH
- 2 Enterprise Resource Planning Systems, Daniel E.O’Leary, Cambridge University Press,2002
- 3 Concepts in Enterprise resource planning, Ellen Monk, Bret Wagner, Cengage learning, Third edition, 2009.
- 4 Essentials of Business Processes and Information Systems, by Simha R. Magal and Jeffrey Word ,2010,
- 5 ERP-A Managerial Perspective, S. Sadagopan, McGraw Hill

**E Books/ Online learning material**

- 1 [www.oracle.com/ERP](http://www.oracle.com/ERP)
- 2 [www.sap.com](http://www.sap.com)
- 3 [www.openerp.com](http://www.openerp.com)
- 4 <https://nptel.ac.in/courses/110/105/110105083/>

**Mapping of COs and PO**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1													
CO 2	1	1	2										1	1	
CO 3	1	1	2										1	1	
CO 4	1	1	2										1	2	
CO 5	1	2	3	1	3			1	1	1	1		1	2	1

**Assessment Table:**

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	5	5	5	-
ISE II* 20 Marks	-	5	5	5	5
ESE Assessment 60 Marks	18	18	18	6	-

**Assessment Pattern:**

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	5	10	24
K2	Understand	10	5	24
K3	Apply	5	5	12
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60

MC2106 : E-Governance		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : --	ISE II*	20 Marks
Credits : 03	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to

- CO 1 Understand the basic concepts, terminology and technology of e-government.
- CO 2 In-depth understanding of e-governance and the necessary experience to ensure successful implementation of the same
- CO 3 Design an application to support and simplify governance for government, citizens, and businesses.
- CO 4 Evaluation of different e-governance models like Critical Flow Model, Interactive-service model/ G2C2G
- CO 5 Develop skills to critically evaluate E-readiness and strategies

### Course Contents

Unit No	Detailed Contents
1	Overview of E-Government and E-Governance, Stages of E-Governance, National E- Governance Plan (NeGP), Mission Mode Projects and their implementation status, E-Governance , Introduction to E-governance, Role of ICT's in e-governance, Need, importance of E-governance
2	Categories of E-governance, Key Issues of E-Governance, Technology, Policies, Infrastructure, Training, Copyrights , Consulting Funds, E-governance Models, Model of Digital Governance, Broadcasting /Wider Dissemination Model
3	Critical Flow Model, Interactive-service model/Government –to-Citizen-to-Government Model (G2C2G), Major areas of E-governance Services, Public Grievances: Telephone, Ration card, transportation, Rural services Land Records, Police: FIR registration, Lost and found, Social services: Death, domicile, school certificates
4	Public information: employment, hospitals, railway, Agricultural sector: Fertilizers, Seeds, Utility payments Electricity, water, telephone, Commercial: income tax, custom duty, excise duty-Governance Infrastructure, stages in evolution and strategies for success, -Governance Infrastructure, stages in evolution and strategies for success
5	Human Infrastructural preparedness, Challenges against E-governance, Study of E-governance initiatives in Indian states, E-readiness, Legal Infrastructural preparedness

### Text Books

- 1 Governance.Com: Democracy in the Information Age, Elaine Ciulla Kamarck
- 2 E-Gov: E-business Strategies for Government by Douglas Holmes

### Reference Books

- 1 Electronic Government: Design, Applications and Management, Ake Gronlund
- 2 Reinventing Government in the Information Age : International Practice in IT-enabled Public Sector Reform, Richard Heeks (Editor) , Routledg, January 2001

- 3 Silcock, R. (2001). What is e-government?. Parliamentary Affairs, 54, 88-101
- 4 Wong, K., Fearon, C. & Philip, G. (2007). Understanding e-government and e-governance: Stakeholders, partnerships and CSR.

### E Books/ Online learning material

- 1 Visit: <http://www.blogs.state.gov/>, <http://www.ready.gov/>,
- 2 Review: issue briefs and other information regarding libraries and e-government at <http://ipac.umd.edu/survey/analysis/e-government-public-libraries>.

### Mapping of COs and Pos

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1														1
CO 2	1														1
CO 3	1	1	2										2	1	
CO 4	1	1	2										1	1	
CO 5	1	2	2					1	1	1			2	1	1

### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	5	5	5	-
ISE II* 20 Marks	5		5	5	5
ESE Assessment 60 Marks	24	24	6	6	-

### Assessment Pattern:

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	10	10	24
K2	Understand	10	5	24
K3	Apply	-	5	12
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60



MC2107 : Mobile Technology		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : --	ISE II*	20 Marks
Credits : 03	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able to

- CO 1 Understanding concepts of Mobile Communication.
- CO 2 Analyse next generation Mobile Communication System.
- CO 3 Analyse various protocols of all layers for mobile and ad hoc wireless communication network
- CO 4 Apply the principles and theories of mobile computing technologies.
- CO 5 Design and develop various mobile computing applications.

### Course Contents

Unit No	Detailed Contents
1	<b>Introduction to Mobile Computing</b> Concept of Mobile Communication, Different generations of wireless technology, Basics of cell, cluster and frequency reuse concept, Noise and its effects on mobile, Understanding GSM and CDMA, Basics of GSM architecture and services like voice call, SMS, MMS, LBS, VAS, Different modes used for Mobile Communication, Architecture of Mobile Computing(3 tier)
2	<b>Mobile computing architecture:</b> Characteristics of Mobile Communication, Application of Mobile Communication, Security Concern Related to Mobile Computing, Middleware and Gateway required for mobile Computing, Making Existing Application Mobile Enable, Mobile IP, Basic Mobile Computing Protocol, Mobile Communication via Satellite • Low orbit satellite • Medium orbit satellite • Geo stationary satellite Satellite phones.
3	<b>Introduction to Android:</b> Overview of Android, What does Android run On – Android Internals?, Android for mobile apps development, Environment setup for Android apps Development, Framework – Android SDK, Eclipse, Emulators – What is an Emulator / Android AVD? Android Emulation – Creation and set up, First Android Application
4	<b>Introduction to iOS:</b> iOS Architecture, Environment Setup, Delegates, UI Controls, UI Views, UI Bars, Graphics, Audio & Video, Accessing Maps in Applications, File Handling, Notifications, Location
5	<b>Introduction to Mobile Networks(Telecom Fundamentals &amp; 2G, 3G)</b> Telecom Basics & Cellular principles, Analogue & digital modulations and multiple access Techniques, GSM(2G), GSM Air interface & channel structure, Protocol Basics, Call Processing: Message and signalling flows, Handover Scenarios Migration from 2G to 3G, UMTS Services and Applications, Air Interface dynamics and various Concepts, Call Processing, High Speed Packet Access (HSDPA, HSUPA) <b>Long Term Evolution (LTE), VOIP, SIP, IMS and OSS(Billing):</b> Improvements & Evolution from 3G, LTE Architecture, LTE protocol

architecture, services and applications, LTE Protocols, LTE Interfaces, LTE Air Interfaces, LTE Call Sequences, Handover Scenarios, LTE Integration with IMS, WLAN, Wi-Fi, Wi-Max, 3GPP, non-3GPP access systems, Voice solutions in LTE: CSFB and VOLTE. Introduction to VOIP, Introduction to H.323, SIP, MGCP, Session Initiation protocol (SIP) & SDP, RTP, RTCP, IP Multimedia Subsystem (IMS), Kenon (online & offline) billing

### Text Books

- 1 Professional ANDROID 4 Application Development By Reto Meier, WROX publication.
- 2 Mobile Computing Technology, Applications and Service Creation By Asoka. K Talukder and Roopa R. Yavagal, Tata McGraw hill, 2nd Edition.

### Reference Books

- 1 Android Studio Development Essentials by Neil Smyth.
- 2 The Definitive Guide to SQL Lite by Michael Owens, 2nd A press Berkeley, CA, USA 2010
- 3 Beginning Android Mark by L Murphy, 1st edition, Wiley India Pvt. Ltd
- 4 Professional Android to Application Development by Sayed Y Hashimi and Satya Komatineni, 1st edition, Wiley India Pvt. Ltd
- 5 Fundamentals of Mobile and Pervasive Computing by Frank Adelsteinm Tata McGraw Hill, 3rd Edition.

### E Books/ Online learning material

- 1 <https://nptel.ac.in/courses/106/106/106106147/>
- 2 <http://www.tutorialpoints.com/android/developer.android.com/training/basics/firstapp>
- 3 <http://pl.cs.jhu.edu/oose/resources/android/Android-Tutorial.pdf>
- 4 <https://www.tutlane.com/tutorial/ios/ios-tutorial>

### Mapping of COs and Pos


PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1														
CO 2	1	2											1		
CO 3	1	2											1		
CO 4	1	2											1		
CO 5	1	2	2		2				1	1			1	2	2

### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	5	5	5	-
ISE II* 20 Marks	-	5	5	5	5
ESE Assessment 60 Marks	24	12	12	12	-

**Assessment Pattern:**

<b>Level No.</b>	<b>Knowledge Level</b>	<b>ISE I*</b>	<b>ISE II*</b>	<b>End Semester Examination</b>
K1	Remember	5	5	18
K2	Understand	5	5	24
K3	Apply	10	10	18
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60



Approved in XXV<sup>th</sup> Academic Council  
Dated: 18<sup>th</sup> April 2023

MC2108 : Block Chain		
Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs / week	ISE I*	20 Marks
Tutorial : --	ISE II*	20 Marks
Credits : 03	End Semester Examination	60 Marks

**Course Outcomes-** After studying this course, students will be able

- CO 1 Understanding the basic fundamentals of Block chain
- CO 2 Understanding the concept of Bit Coin Block chain
- CO 3 Demonstrate the application of hashing and public key cryptography in protecting the block chain.
- CO 4 Implement cryptographic algorithms for security.
- CO 5 Analyze the emerging trends in Block chain and Use cases

### Course Contents

Unit No	Detailed Contents
1	Introduction – Basic ideas behind Blockchain, how it is changing the landscape of digitalization, introduction to cryptographic concepts required, Hashing, public key cryptosystems, private vs. public, Blockchain and use cases, Hash Puzzles, Introduction to Bitcoin Blockchain
2	Bitcoin Blockchain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc Downside of Bitcoin – mining: Mining explained, The Bitcoin network, The Bitcoin Mining Process, Mining Developments
3	Asymmetric key cryptography: AES structure, Analysis of AES , Key distribution Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Analysis of RSA, Diffie-Hellman Key exchange
4	Alternative coins – Ethereum and Smart contracts, Alternative coins – Ethereum continued, IOTA, The real need for mining – consensus – Byzantine Generals Problem, and Consensus as a distributed coordination problem – Coming to private or permissioned block chains
5	Introduction to Hyper ledger, Permissioned Blockchain and use cases – Hyper ledger, Corda Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems and others.

### Text Books

- 1 Mastering Bitcoin: Unlocking Digital Crypto currencies, by Andreas Antonopoulos
- 2 Bitcoin and Crypto currency Technologies: A Comprehensive Introduction by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Princeton University Press (July 19, 2016).

### Reference Books

- 1 Bitcoin: A Peer-to-Peer Electronic Cash System by Satoshi Nakamoto.
- 2 Blockchain Applications: A Hands-on Approach by Arshdeep Bahga and Vijay K. Madiseti.



- 3 A survey of attacks on Ethereum smart contracts by Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli.
- 4 Mastering Bitcoin: Programming The Open Blockchain by Andreas M. Antonopoulos, O'Reilly Publication.
- 5 Blockchain: Ultimate Beginner's Guide to Blockchain Technology- Crypto currency, Smart Contracts, Distributed Ledger, Fintech, and Decentralized Applications by Matthew Connor Kindle Edition, s2017
- 6 Blockchain by Melanie Swa, O'Reilly Publication.

### E Books/ Online learning material

- 1 Hyper ledger Fabric - <https://www.hyperledger.org/projects/fabric>
- 2 [https://nptel.ac.in/content/syllabus\\_pdf/106104220.pdf](https://nptel.ac.in/content/syllabus_pdf/106104220.pdf)
- 3 <https://www.coursera.org/courses?query=blockchain&page=1>

### Mapping of COs and Pos

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1												1		
CO 2	2												1		
CO 3	2	1											1		
CO 4	2	2	2		2			1	1				1	2	2
CO 5	2	1											1		

### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	5	5	5	-
ISE II* 20 Marks	5		5	5	5
ESE Assessment 60 Marks	12	12	18	12	6

### Assessment Pattern:

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	5	5	18
K2	Understand	10	10	24
K3	Apply	5	5	18
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	60



<b>MC2109 : Machine Learning</b>		
<b>Teaching Scheme</b>	<b>Examination Scheme</b>	
<b>Lectures : 03 Hrs / week</b>	<b>ISE I*</b>	<b>20 Marks</b>
<b>Tutorial : --</b>	<b>ISE II*</b>	<b>20 Marks</b>
<b>Credits : 03</b>	<b>End Semester Examination</b>	<b>60 Marks</b>

**Course Outcomes-** After studying this course, students will be able to

- CO 1 Understand basics of machine learning techniques
- CO 2 Understand a wide variety of learning algorithms
- CO 3 Analyze various neural network models for application development.
- CO 4 Develop skills of using recent machine learning techniques and solve practical problems.
- CO 5 Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

### Course Contents

Unit No	Detailed Contents
1	Probability Theory, Linear Algebra, Convex Optimization, Statistical Decision Theory - Regression, Classification, Bias Variance, Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component, Regression, Partial Least squares, Linear Classification, Logistic Regression, Linear Discriminant Analysis, Perceptron, Support Vector Machines
2	Neural Networks - Introduction, Early Models, Perceptron Learning, Back-propagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation, Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multi-way, Splits, Missing Values, Decision Trees - Instability Evaluation Measures
3	Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting, Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks
4	Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation, Partition Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering
5	Gaussian Mixture Models, Expectation Maximization, Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications)

### Text Books

- 1 Introduction to Machine Learning By Ethem Alpaydm, PHI, Third Edition, ISBN

No. 978-81-203- 5078-6.

- 2 Understanding Machine Learning (From Theory to Algorithms) By Shaishalev-Shwartz and Shai Ben-David, Cambridge University Press, First Edition, ISBN No. 978-1-107-51282-5.

### Reference Books

- 1 Pattern Recognition and Machine Learning By Christopher M. Bishop, McGraw-Hill, ISBN No. 0- 07-115467-1.
- 2 Machine Learning By Tom Mitchell, McGraw-Hill, First Edition, ISBN No. 0-07-115467-1.
- 3 Deep Learning (Adaptive Computation and machine Learning Series) By Ian Goodfellow and Yoshua Bengio, Massachusetts London, England, ISBN No. 9780262035613.

### E Books/ Online learning material

- 1 <https://nptel.ac.in/courses/106/106/106106139/>

### Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1												1		
CO 2	2												1		
CO 3	2	1											1		
CO 4	2	2	2		2			1	1				1	2	2
CO 5	2	1											1		

### Assessment Table:

Assessment Tool	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
ISE I* (Class Test) 20 Marks	5	5	5	5	-
ISE II* 20 Marks	5		5	5	5
ESE Assessment 60 Marks	18	18	12	12	-

### Assessment Pattern:

Level No.	Knowledge Level	ISE I*	ISE II*	End Semester Examination
K1	Remember	5	5	18
K2	Understand	10	10	24
K3	Apply	5	5	18
K4	Analyze	-	-	-
K5	Evaluate	-	-	-
K6	Create	-	-	-
<b>Total</b>		20	20	20

MC2110 : Lab Adv. Java		
Teaching Scheme	Examination Scheme	
Practical : 4Hrs/Week	ISE I*	50 Marks
Credits : 02	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able

CO 1 Develop Database & its related Operations using Servlet.

CO 2 Implement the advanced environment using Hibernate, Struct, Spring in their Application

CO 3 Develop a mini project using layered MVC Architecture

### Course Contents (Indicative List of Experiments not restricted to)

- 1 Write a program for creating mini chat application using socket programming.
- 2 Write a program for Addition and Subtraction using concept of RMI programming
- 3 Write a program to implement CRUD operation in JDBC
- 4 Create Exam Registration Form using JDBC Connectivity
- 5 Write a program for creating Edit menu for Notepad using Frame
- 6 Write a program for creating simple Servlet with JDBC.
- 7 Create an employee information form by using JSP
- 8 Write a program for implementing concept of MVC Architecture.
- 9 Write a program for implementing concept of Hibernate, Stuct, Spring
- 10 Write a program for implementing concept of Maven Project
- 11 Write a program for implementing concept of Web Service
- 12 Write a program for implementing concept of J-Unit Testing.
- 13 Write a program for implementing concept of JAXB

### Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I*	End Semester Examination
S1	Imitation	15	08
S2	Manipulation	15	07
S3	Precision	10	05
S4	Articulation	10	05
S5	Naturalization	-	-
<b>Total Marks</b>		<b>50</b>	<b>25</b>

### Mapping of COs and Pos

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	2	1	2								1	2	
CO 2	1	2	2	1	2								1	2	
CO 3	1	2	2	1	2			1	2	2			1	2	



MC2111 : Lab ASP .Net and C#		
Teaching Scheme	Examination Scheme	
Practical : 2Hrs/Week	ISE I*	25 Marks
Credits : 01	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able to

- CO 1 Create and connect with Database using ASP.NET & SQL Server
- CO 2 Implement web services using AJAX.
- CO 3 Develop a mini project using ASP.Net Framework.

**Course Contents (Indicative List of Experiments not restricted to)**

- 1 To Study the ASP.Net Framework
- 2 To Study & Create Presentation Layer using HTML & CSS
- 3 To Study & Create Master Page, User Control etc
- 4 To Study & Use Standard Controls in ASP.NET
- 5 To Study & Use Validation Controls in ASP.NET
- 6 To Study, Create and Connect with Database using ASP.NET & SQL Server
- 7 To Study & Implement Web Services
- 8 To Study & Implement AJAX in ASP.NET
- 9 To Study & Deploy Project on IIS
- 10 Mini Project

**Assessment :**

Term work shall consist of record of minimum eight experiments based on performance, software modelling and study from the above list

**Assessment Pattern:**

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	08	08
S2	Manipulation	07	07
S3	Precision	05	05
S4	Articulation	05	05
S5	Naturalization	-	-
<b>Total Marks</b>		<b>25</b>	<b>25</b>

**Mapping of Course outcome with Program Outcomes and Program Specific Outcomes**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	2	1	2								1	2	
CO 2	1	2	2	1	2								1	2	
CO 3	1	2	2	1	2			1	2	2			1	2	



Approved in XXV<sup>th</sup> Academic Council  
Dated: 18<sup>th</sup> April 2023

MC2112 : Lab Cloud Computing		
Teaching Scheme	Examination Scheme	
Practical : 2Hrs/Week	ISE I*	25 Marks
Credits : 01	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able

- CO 1 Understanding private clouds: Open Stack, Eucalyptus etc.
- CO 2 Apply cloud computing for various application developments.
- CO 3 Analyze cloud security techniques and challenges.

### Course Contents (Indicative List of Experiments not restricted to)

- 1 Introduction to cloud computing.
- 2 Installing ubuntu (Server Edition) using virtual box, and study virtualization.
- 3 Writing Sample applications on cloud using Google App Engine.
- 4 Implementation of SOAP web service in C#/JAVA application
- 5 Understanding Software as a service: Sales Force
- 6 Understanding private clouds: OpenStack, Eucalyptus
- 7 Setting up using an instance on public IaaS Cloud, using Amazon AWS.
- 8 Exploring Git-Hub to learn features such as
  - a. How to create repositories
  - b. How to upload/download source code
  - c. Making code commits
  - d. Git-Hub issues tracking features.
- 9 To study cloud security challenges.
- 10 To study various applications of cloud computing.

### Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	08	08
S2	Manipulation	07	07
S3	Precision	05	05
S4	Articulation	05	05
S5	Naturalization	--	--
<b>Total Marks</b>		<b>25</b>	<b>25</b>

### Mapping of COs and Pos

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	2	1	2								1	2	
CO 2	1	2	2	1	2								1	2	
CO 3	1	2	2	1	2								1	2	

MC2113 : Minor Project		
Teaching Scheme	Examination Scheme	
Practical : 04 Hrs/Week	ISE I*	50 Marks
Credits : 02	End Semester Evaluation	25 Marks

**Course Outcomes-** After studying this course, students will be able

- CO 1 Demonstrate the ability to manage a project including planning, scheduling and risk assessment/management individually or in group.
- CO 2 Demonstrate to work as professionals with portfolios ranging from data management, network configuration, software design, management and administration of entire system.
- CO 3 Demonstrate proficiency in rapid software development techniques on regular basis.
- CO 4 Demonstrate technical report writing skills for the project apart from development and presentation.

### Course Contents

- 1 The project batches of 2-3 students should be formed, which will work on the project allocated by the department. Term work submission should be done in the form of a joint report. The term work assessment will be done jointly by teachers appointed by Head of the Institution. The oral examination will be conducted by an internal and external examiner as appointed by the Institute.
- 2 Project work should be continually evaluated based on the contributions of the group members, originality of the work, innovations brought in, research and developmental efforts, depth and applicability, etc.
- 3 The mid-term evaluations should be done, which includes presentations and demos of the work done.
- 4 Project report should be of 35 to 40 pages (typed on A4 size sheets). For standardization of the project reports the following format should be strictly followed.
- 5 **Format of Project Report-**
  1. **Page Size:** Trimmed A4
  2. **Top Margin:** 1.00 Inch
  3. **Bottom Margin:** 1.32 Inches
  4. **Left Margin:** 1.5 Inches
  5. **Right Margin:** 1.0 Inch
  6. **Para Text:** Times New Roman 12 Point Font
  7. **Line Spacing:** 1.5 Lines
  8. **Page Numbers:** Right Aligned at Footer. Font 12 Point. Times New Roman
  9. **Headings:** Times New Roman, 14 Point Bold Face
  10. **Certificate:** All students should attach standard format of Certificate as described by the department. Certificate should be awarded to batch and not to individual student. Certificate should have signatures of Guide, Head of Department and Principal/ Director.
  11. **Index of Report:**
    - a. Title Sheet
    - b. Certificate
    - c. Acknowledgement
    - d. Table of Contents
    - e. List of Figures
    - f. List of Tables

**12. References:** References should have the following format

For Books: “Title of Book”, Authors, Publisher, Edition

For Papers: “Title of Paper”, Authors, Journal/Conference Details, Year

**Useful Links:**

- 1 <http://www.geeksforgeeks.org/>
- 2 <https://in.udacity.com/>
- 3 <https://graphics.stanford.edu/~seander/bithacks.html>
- 4 [https://www.youtube.com/results?search\\_query=mycodeschool](https://www.youtube.com/results?search_query=mycodeschool)
- 5 <https://www.hackerrank.com/>

**Assessment Pattern:**

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	--	--
S2	Manipulation	10	05
S3	Precision	10	05
S4	Articulation	10	05
S5	Naturalization	20	10
<b>Total Marks</b>		<b>50</b>	<b>25</b>

**Mapping of COs and Pos**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	3	1	2	1	1	1	2	1	1	1	2	2	1
CO 2	2	2	3	1	2	1			2	1	1	1	2	2	1
CO 3	2	2	3	1	2	1			2	2	1	1	2	3	1
CO 4	2	2	3	1	2	1			2	2	1	1	2	2	1



Approved in XXV<sup>th</sup> Academic Council  
Dated: 18<sup>th</sup> April 2023

MC2114 : Dissertation		
Teaching Scheme	Examination Scheme	
Practical : 30 Hrs/Week	ISE I*	100 Marks
Credits : 24	End Semester Evaluation	100 Marks

**Course Outcomes-** After studying this course, students will be able

- CO 1 Demonstrate the ability to manage a project including planning, scheduling and risk assessment/management individually or in group.
- CO 2 Demonstrate to work as professionals with portfolios ranging from data management, network configuration, software design, management and administration of entire system.
- CO 3 Demonstrate proficiency in rapid software development techniques on regular basis.
- CO 4 Demonstrate technical report writing skills for the project apart from development and presentation.

### Course Contents

- 1 The project work to be carried out individually which commences in the Semester IV as per the project assigned to the each individual by the respective industry. It shall include the problem definition, literature survey, approaches for handling the problem, finalizing the methodology for the project work and system design etc.
- 2 Term work submission should be done in the form of an individual report. Assessment of the term work will be done by the internal guide. The oral examination will be conducted by an internal and external examiner as appointed by the Institute.
- 3 Project work should be continually evaluated based on the contributions of the group members, originality of the work, innovations brought in, research and developmental efforts, depth and applicability, etc.
- 4 The mid-term evaluations should be done, which includes presentations and demos of the work done.
- 5 Project report should be of 35 to 40 pages (typed on A4 size sheets). For standardization of the project reports the following format should be strictly followed. **Format of Project Report-**
  1. **Page Size:** Trimmed A4
  2. **Top Margin:** 1.00 Inch
  3. **Bottom Margin:** 1.32 Inches
  4. **Left Margin:** 1.5 Inches
  5. **Right Margin:** 1.0 Inch
  6. **Para Text:** Times New Roman 12 Point Font
  7. **Line Spacing:** 1.5 Lines
  8. **Page Numbers:** Right Aligned at Footer. Font 12 Point. Times New Roman
  9. **Headings:** Times New Roman, 14 Point Bold Face
  10. **Certificate:** All students should attach standard format of Certificate as described by the department. Certificate should be awarded to batch and not to individual student. Certificate should have signatures of Guide, Head of Department and Principal/ Director.



**11. Index of Report:**

- a. Title Sheet
- b. Certificate
- c. Acknowledgement
- d. Table of Contents
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- f. List of Tables

**12. References:** References should have the following format

For Books: "Title of Book", Authors, Publisher, Edition

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**Useful Links:**

- 1 <http://www.geeksforgeeks.org/>
- 2 <https://in.udacity.com/>
- 3 <https://graphics.stanford.edu/~seander/bithacks.html>
- 4 [https://www.youtube.com/results?search\\_query=mycodeschool](https://www.youtube.com/results?search_query=mycodeschool)
- 5 <https://www.hackerrank.com/>

**Assessment:** Specify the details of ISE I, End semester Evaluation like oral/ practical examination/ practical performance etc.

**Assessment Pattern:**

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	--	--
S2	Manipulation	20	20
S3	Precision	20	20
S4	Articulation	20	20
S5	Naturalization	40	40
<b>Total Marks</b>		<b>100</b>	<b>100</b>

**Mapping of COs and Pos**

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	3	1	2	1	1	1	2	1	1	1	2	2	1
CO 2	2	2	3	1	2	1			2	1	1	1	2	2	1
CO 3	2	2	3	1	2	1			2	2	1	1	2	3	1
CO 4	2	2	3	1	2	1			2	2	1	1	2	2	1

  
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