DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
FACULTY OF TECHNOLOGY & ENGINEERING
THE M. S. UNIVERSITY OF BARODA

Scheme of Teaching and Examination of Master of Computer Applications (MCA) 2 years Postgraduate course. (Effective from 2020-21)

Subject Code	Subject	Teaching (Contact Hours/Week)				Assessment Marks			Min. Marks for Passing		Total Max. Marks	Total Credit	
		L	Tu	Pr/Drg	Total	Theory		Tw &/or Practical incl. Viva	Theory	Tw &/or Practical incl. Viva		Theory	Practical
						Internal	External						
MCA-I Semester-I (FSMCA-I) (Effective from 2020-21)													
Bridge Courses													
MCAB101	Computer Programming	2	0	2	4	-	-	-	-	-	-	-	-
MCAB102	Fundamentals of Computer Science	2	0	0	2	-	-	-	-	-	-	-	-
Regular Courses													
	Discrete Mathematics**	3	1	0	4	30	70	0	40	0	100	4	0
MCA2101	C++ Programming	3	1	2	6	30	70	50	40	20	150	4	2
MCA2102	Computer Organization	3	1	2	6	30	70	50	40	20	150	4	2
MCA2103	Computer Network	3	1	2	6	30	70	50	40	20	150	4	2
MCA2104	Data Structures	3	1	2	6	30	70	50	40	20	150	4	2
Total		**15+4=19**	**5**	**8+2=10**	**28+6=34**	**150**	**350**	**200**			**700**	**20**	**8**
MCA-I Semester-II (SSMCA-I)													
Bridge Courses													
MCAB201	Communication Skills	0	0	2	2	-	-	-	-	-	-	-	-
Regular Courses													

MCA2201	Database Management System	3	1	2	6	30	70	50	40	20	150	4	2
MCA2202	Java Programming	3	1	2	6	30	70	50	40	20	150	4	2
MCA2203	Operating System	3	1	2	6	30	70	50	40	20	150	4	2
MCA2204	Python Programming	3	1	2	6	30	70	50	40	20	150	4	2
	Elective-I	3	1	2	6	30	70	50	40	20	150	4	2
Total		**15**	**5**	**10+2=12**	**30+2=32**	**150**	**350**	**250**			**750**	**20**	**10**

Sem-II
Elective – I
MCA2205 Artificial Intelligence
MCA2206 Data Science and Applications
MCA2207 Linux Administration & Network Programming
MCA2208 Network Security
MCA2209 Computational Optimization and Statistical Methods

MCA-II Semester-I (FSMCA-II) (Effective from 2021-22)													
Subject Code	**Subject**	**Teaching (Contact Hours/Week)**				**Assessment Marks**			**Min. Marks for Passing**		**Total Max. Marks**	**Total Credit**	
		L	**Tu**	**Pr/Drg**	**Total**	**Theory**		**Tw &/or Practical incl. Viva**	**Theory**	**Tw &/or Practical incl. Viva**		**Theory**	**Practical**
						Internal	**External**						
MCA2301	.NET Technologies	3	1	2	6	30	70	50	40	20	150	4	2
MCA2302	Computer Graphics	3	1	2	6	30	70	50	40	20	150	4	2
MCA2303	Software Engineering	3	1	0	4	30	70	0	40	0	100	4	0
	Elective-II	3	1	2	6	30	70	50	40	20	150	4	2
	Elective-III	3	1	2	6	30	70	50	40	20	150	4	2

Total		**15**	**5**	**8**	**28**	**150**	**350**	**200**			**700**	**20**	**8**
MCA-II Semester-II (SSMCA-II)													
MCA2401	Project/Internship	-	-	2	2	-		300		120	300		6

Sem-III	
Elective – II	**Elective – III**
MCA2304 Advance Computing Technologies	MCA2309 Advance Java Technologies
MCA2305 Data Mining and Data Warehousing	MCA2310 Big Data Analytics
MCA2306 Information Security	MCA2311 Machine Learning and Applications
MCA2307 Internet of Things	MCA2312 Mobile Application Programming
MCA2308 Web Technologies & Programming	MCA2313 Mobile Computing

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MCA-I

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MCA2101 C++ PROGRAMMING
FSMCA-I

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Studentshave already studied structured programming using C.
Objectives: To teach the fundamentals of object oriented concepts and implement it using C++.
Outcome: Students will learn object oriented concepts with its implementation in C++.

Sr. No.	Topic	No. of lecture required	Weightage %
1	Introduction to Object Oriented concepts	1	2.5
2	Quick Revision of C	8	20
3	Function overloading & templates	4	10
4	Introduction to class and its fundamentals	6	15
5	A closer look at class and its related concepts	4	10
6	Friend functions and friend classes	2	5
8	Inheritance and runtime polymorphism	6	15
9	Operator overloading	6	15
10	Exception handling in C++	2	5
11	Introduction to files and its operations	2	5
	Total Lectures	**40**	

Reference:
1. How to Program C++ by Dietel & Dietel
2. Turbo C++ by Robert Lafore

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MCA2102 – COMPUTER ORGANIZATION
FSMCA - I

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: NA

Objectives: - This course will enable students to analyze and understand the design of a simple computer. To understand the aspects of computer architecture and program performance. To understand the principle, operation and working of digital electronics.

Outcome: After learning the course the students should be able to:

- Understand the organization of the control unit, arithmetic and logical unit, memory unit and I/O unit. Apply knowledge of the processor's internal registers and operations by use of a PC based microprocessor simulator
- Apply knowledge of Boolean algebra and other minimization techniques for digital circuit design.
- Identify, formulate and solve a problem based on combinational and sequential circuits
- Select the appropriate hardware and software tools for combinational and sequential circuit design.

Sr. No.	Topic	No. of Lectures	Weightage %
1	**Introduction** : Function and structure of a computer, functional components of a computer, Interconnection of components, Performance of a computer	2	4
2	**Representation of Instructions**: Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures	5	12
3	**Processing Unit:** Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Microprogrammed control unit.	7	18
4	**Memory Subsystem:**Types of Memory; Memory Hierarchies; Organisation of Static and Dynamic Semiconductor Memories; Associative Memory Organization; Cache Organisation, CPU- memory interaction, Cache memory and related mapping and replacement policies, Virtual memory	7	18
5	**Input/Output Subsystem:** Device Interfacing and Selection; Memory and I/O Mapped I/Os; Modes of Data Transfer-Programmed; Interrupt and DMA Driven I/O-Interrupt Types and Priority Schemes;	6	15

7	**Combinational Logic Design:** Adders, Subtractors (Half & Full), Binary parallel adder, 4 Bit parallel sub tractor & comparator, Multiplexer, De-multiplexer, Decoder & Encoder, Design of a 4-Bit Binary to Gray, Gray to Binary, Binary to BCD, BCD to XS-3, BCD to Gray etc code convertors	6	15
8	**Flip-Flops** :-Classification of sequential circuit, Latches & Flip-Flops(S-R, J-K, T, D), Excitation table of all Flip-Flops, Asynchronous inputs, Introduction about the applications of flip-flops (e.g. shift-register, counters, sequential circuits)	7	18
		40	**100**

References:

1. Digital Logic and Computer Design, M.Morris Mano
2. Morris Mano, “Computer System Architecture”, Pearson Education
3. Andrew S. Tanenbaum and Todd Austin, “Structured Computer Organization”, Pearson Education
4. Fundamentals of Digital Circuits by A. Anand Kumar (PHI Publication)
5. Hamacher, Vranesic, Zaky, “Computer Organization”, McGraw Hill
6. N D Jotwani, “Computer system organization”, McGraw Hill

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MCA2103 COMPUTER NETWORKS
FSMCA – I

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	: 50
Practical	: 2 Hrs.	Total	:150

Objectives: -To enable students to understand and realize how devices are interconnected to form a network and used for information and resource sharing. Also help them in understanding internet/intranet concepts and other contemporary networks that use wireless technologies, etc.

Outcome: After the completion of this course, students will have required knowledge to configure a network for a small organization and also have required knowledge for developing network applications.

Sr. No.	Topic	No. of Lectures	Weightage in %
1	Introduction : Introduction to Computer Networks, Network Architecture, OSI reference model, services, network standardization.	4	7.5
2	Physical Layer : Basics of data communication, Guided Transmission Media, Wireless Transmission, Switching	2	7.5
3	Data Link Layer : Design issues, Error detection and correction, Elementary Data Link Protocols, Sliding window protocols, Data Link Protocols in Internet	6	15
4	Medium Access Sub-layer : Channel Allocation, Multiple Access Protocols, IEEE standard 802 standards for Ethernet LAN, Wireless LANS, Broadband Wireless, Data Link Layer Switching, Gigabit Ethernet	8	20
5	Network Layer : Design issues, Routing algorithms, Congestion control, Internetworking, Network layer in the Internet	12	30
6	Transport Layer : Design issues, Transport Service, Elements of Transport Protocol, Internet Transport Protocols – UDP & TCP	6	15
7	Application Layer :Domain Name System, Electronic mail, WWW	2	5
	Total	**40**	**100**

References:

1. Computer Networks:A. S. Tanenbaum

2. Computer Networking : Kurose & Ross
3. Data & Computer Communications : William Stallings
4. Internetworking with TCP//IP – Volume III Douglas Comer

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MCA2104 DATA STRUCTURES
FS MCA– I

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Studentsshouldhaveanunderstandingofany basic programming language.
Objectives: Understanding of a structured programming language is required for the student to appreciate andunderstand the different data structures that can be used during programming. This subject discussesdifferent data structures, their complexities and applications as compared to time and spacemanagement.
Outcome: After completion of this course the students will be able to decide which data structure is bestsuited for any given application.

Sr. No.	Topic	No. of Lectures	Weightage in %
	DATA STRUCTURES		
1	**Introduction and Overview** Introduction to data structures, basic terminology, elementary data organization, data structures , data structureoperations, algorithmic notations, complexity of algorithms, overview of array and string	03	08
2	**Linked Lists** Introduction to linked lists, representation of linked lists in memory, various operations onlinked lists, two way lists, circular linked lists, applications of linked lists	06	15
3	**Stacks** Introduction to stacks, array representation of stacks, operations on stacks, application of stacks	04	10
4	**Queues** Introduction to queues,representation of queue using arrays and linked lists, various operations on queues, circular queues, deques,priority queues, application of queues	05	10
5	**Trees** Terminologies, definition and concepts, binary trees, representing binary trees in memory,traversals and other operations on binary trees, threaded binary trees, binary search trees,heap trees; heap sort, height balanced binary	08	20

	trees (avl trees), weight balanced trees(huffman tree), general trees, b-trees & b+ trees		
6	**Graphs:** Introduction to graphs, representing graph in memory, operations on graph, traversing and searching, applications of graphs	05	15
7	**Sorting and Searching:** Introduction, insertion sort, selection sort, bobble sort, merging, merge-sort, quick sort, radix sort, searching and data modification	04	10
8	**Hashing:** Hash tables, hashing techniques and functions, collision resolution techniques – open addressing & chaining	03	07
9	FILE STRUCTURES: Concepts of fields, records and files, sequential, indexed and relative/random file organization, indexing structure for index files, hashing for direct files, multi-key file organization and access methods	02	05
	Total	**40**	**100**

References:

1. Data Structures by Lipschultz (Schaum Series)
2. An Introduction to Data Structures with Applicationsby Jean-Paul Tremblay and Paul G. Sorenson, Tata McGrawHill
3. Data Structures using C & C++ by Tanenbaum, Prenctice-Hall International
4. Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia
5. Fundamentals of Data Structures in C++ by Sartaj Sahani
6. Data Structures: A Pseudo-code approach with C by Gilberg & Forouzan, Thomson Learning

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MCAB101 COMPUTER PROGRAMMING
FS MCA– I (BRIDGE COURSE)

Theory	: 2 Lectures	Marks (Theory)	:
Tutorial	: 0 Hr	Marks (Pr/Tw/Viva)	:
Practical	: 2 Hrs.	Total	:

Pre-requisites: Nil
Objectives: To understand the various design issues involved in the development of a programming language and appreciate the features of any programming language and thereby enable the students in applying the studied fundamentals to write efficient programs.
Outcome: By completion of this course, the students will be able to represent a real-world computation problem in terms of a computer program written in C programming language. A student will also be able to implement the necessary logic required to solve the given problem using various language constructs learned during this course.

Sr. No.	Topic	No. of Lectures	Weightage in %
	STRUCTURED PROGRAMMING		
1	**Introduction to computer and programming:** Introduction, basic block diagram and functions of various components of computer, basic concepts of hardware and software, types of software, compiler and interpreter, evolution of programming languages, concepts of machine level, assembly level and high level programming, flow charts and algorithms.	5	10
2	**Fundamentals of C:** Features of C language, structure of C program, C character set, comments, header files, data types, constants and variables, operators, expressions, evaluation of expressions, type conversion, precedence and associativity, C tokens	5	15
3	**Control structures in C:** Simple statements, decision making statements, simple if, if..else statement, else..if statement, switch case, looping statements, entry controlled loops, exit controlled loops, nesting of control structures, break and continue, goto statement	8	15
4	**Array & String:** Concepts of array, one and two dimensional arrays, declaration and initialization of arrays, string, string storage, built-in-string functions	5	15
5	**Functions:**	5	15

	Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function, macros, pre-processing		
6	**Pointers:** Basics of pointers, pointer to pointer, pointer and array, pointer to array, array of pointers, functions returning a pointer, pointer arithmetic	3	10
7	**Structure and Union:** Basics of structure, structure members, accessing structure members, nested structures, array of structures, structure and functions, structures and pointers, unions	4	10
8	**Dynamic memory allocation:** Introduction to dynamic memory allocation, malloac, calloc, realloc	2	05
9	**File management:** Introduction to file management and its functions	3	05
	Total	**40**	**100**

References:

1. Programming in ANSI C by E. Balaguruswamy, TMH
2. The ‘C’ programming language - B.W.Kernighan, D.M.Ritchie, PHI
3. Programming in C Ansi standard by Yashwant Kanetkar
4. Programming in C - Gottfried B.S., TMH
5. A Structured Programming Approach using C – B.A. Forouzan & R.F. Gillberg, THOMSON Indian Edition
6. Let us C - Y.Kanetkar, BPB Publications

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MCAB102 – FUNDAMENTALS OF COMUPTER SCIENCE
FSMCA – I (BRIDGE COURSE)

Theory	: 2 Lectures	Marks (Theory)	:
Tutorial	: 0 Hr	Marks (Pr/Tw/Viva)	:-
Practical	: 0 Hrs.	Total	:

Pre-requisites: NA

Objectives: - Understanding the fundamentals of computers, digital systems, hardware and software systems, latest technologies and evolvements in computer science

Outcome: After learning the course the students would know fundamentals of computers, digital systems, hardware and software systems, latest technologies and evolvements in computer science

Sr. No.	Topic	No. of Lectures	Weightage %
1	Evolution of Computers, Numbering System: Different Numbering System Decimal, Binary, Representation of signed numbers and Binary arithmetic in computers, Octal numbers, Hexadecimal numbering system	4	20
2	Binary Codes: (i) Classification of binary codes (ii) 8421 BCD code (iii) XS-3(Excess-3) code (iv) Gray code (v) Error detecting code and Error correcting code	4	20
3	Logic Gates: The AND gate, The OR gate, The NOT gate, Universal gates NAND and NOR gates, The Exclusive OR gate, The Exclusive NOR gate	3	15
4	Boolean Algebra -Logic operations (AND,OR,NOT,NAND,NOR,X-OR and X-NOR) -Laws of Boolean algebra -Reducing Boolean expressions -Boolean functions & their representation(SOP,POS form) -Karnaugh map	6	30
5	Software in Computers Operating System, Functions of O/S, Types of O/S, Program Language Translators, Assembler, Compiler, Interpreter, Utility Programs, Communication Software, Performance Monitoring Software, Application Software	1	5
6	Latest Trends and developments in Computer Science	2	10
	Total Lectures	**20**	**100**

References:

1. Digital Logic and Computer Design, M.Morris Mano
2. Internet Sources

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MCAB201 COMMUNICATION SKILLS
SS MCA– I (BRIDGE COURSE)

Tutorial	:	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	:50

Pre-requisites: Nil
Objectives: To learn various communication and presentation skills in English for technical and non technical communication.
Outcome: By completion of this course, the students will be able to communicate and present their views in English.

Sr.	Topics	Teaching Hours	Module Weightage
1	Basics of Communication Kinesics, Definition and Process of Communication, Paralinguistics, Proxemics, Chronemics	4	15 %
2	Presentation Strategies Defining the Purpose of Presentation, How to Make an Effective Presentation: Analyzing audience and locale, Organizing content and preparing an outline	2	10 %
3	Listening Ability Hearing and Listening, Types of Listening, Barriers to Effective Listening, Traits of a Good Listener	2	10 %
4	Reading Fluency Introduction, Reading Strategies, Techniques of reading, Developing Reading Comprehension	4	15 %
5	Writing : Mastering the Final Skill Paragraph writing (Application Que), Business Letters (Application Que), Report Writing (Application Que), Completion of a Given Story (Application Que), E-mail etiquettes	6	25 %
6	Enriching Language through Literature	6	25 %

References:

1. Vibrant English, Publisher : Hyderabad: Orient BlackSwan
2. Business Communication: Making Connections in a Digital World, Lesikar R V, Flatley M E ,Rentz K and Pandey, Tata Mcgrow Hill
3. Communication Skills 2011: Kumar S and Lata P, Oxford University Press

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MCA2201 DATABASE MANAGEMENT SYSTEM
SSMCA–I

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Knowledge of Programming, Data Structure and Algorithms

Objectives: 1. To understand the different issues involved in the design and implementation of adatabase system.2. To study the physical and logical database designs, database modeling, relational,etc.3. To understand and use data manipulation language to query, update, and manage adatabase4. To develop an understanding of essential DBMS concepts such as: database security,integrity, concurrency,5. To design and build a simple database system and demonstrate competence with thefundamental tasks involved with modeling, designing, and implementing a DBMS.

Outcome: Students will be able to:

- Define and design data models for database systems, database schema and database instances.
- Identify the methodology of conceptual modeling through Entity Relationship model and Relational Model.
- Develop an understanding of the differences between OODBMS, ORDBMS and RDBMS and the practical implications of each approach.
- Analyze and design a real database application.
- Improve teamwork management skills; enhance negotiation and discussion skills by developing a project by working in a team.
- Will become proficient in SQL and PL/SQL.

Sr. No.	Topic	No. of lectures required	Weightage in %
1	Introduction to Database Management System and comparison of the advantages over the third generation languages. The basic properties and the architecture of Databases.	2	5
2	E-R Model and Extended E-R Model	4	10
3	The Relational Model – concept, properties and relational algebra	4	10
4	Structured Query Language(SQL)	4	10
5	Programming Language/Structured Query Language (PL/SQL)	6	15
6	Theory of Normalization - Functional dependencies, Armstrong's Axioms, Closure, Canonical cover, 1^{st}, 2^{nd}, 3^{rd}, BCNF, 4^{th} and 5^{th} Normal Forms with their anomalies and conditions.	5	12.5
8	Transaction Control, Consistency and Concurrency	5	12.5
9	Storage Structures, Indexing	3	7.5
10	Backup and Recovery	2	5

11	Case Study: Oracle Internals	3	7.5
12	Brief description of Hierarchical Database Management System, Network Database Management System, Object-Relational / Object-Oriented Database Management System, etc.	2	5
	Total	**40**	**100**

References:

1. H.F. Korth , A. Silberschatz and Sudarshan : Database System Concepts
2. Elmasri&Navathe: Fundamentals of Database Systems
3. James Martin:Computer Database Organization
4. C.J. Date: An Introduction to Database Systems
5. Ivan bayross: SQL & PL/SQL
6. Oracle Press Reference books/manuals

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MCA2202 JAVA PROGRAMMING
SSMCA– I

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Studentsshouldhavebasic programming Knowledge.
Objectives: To understand platform independent object oriented programming and java as base language for advanced technology like three tier architecture applications, cloud computing and web development. And also for making commercial applications which are using Java Technologies.
Outcome: Students are able to learn: Object oriented programming concepts of java. Comprehend building blocks of OOPs language, inheritance, package and interfaces. Identify exception handling methods. Develop multithreading object oriented programs and event handling programs.

Sr. No.	Topic	No. of Lectures	Weightage in %
	OVERVIEW OF BASIC OOP CONCEPTS:		
1	Need for object-oriented paradigm ,Introduction to Java, History of Java, What is machine dependent code and platform independent code, advantages of Java, Platform independent feature of Java, What makes Java Platform Independent, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, classes and objects, constructors, methods, this keyword, garbage collection, arrays of objects, overloading methods and constructors, parameter passing, recursion, string handling, inheritance, super keyword, method overriding, polymorphism, runtime binding, abstract classes	15	25
	PACKAGES AND INTERFACES		
2	Defining, Creating and Accessing a Package, Understanding ,CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending, interfaces. Exploring packages – java.lang, java.util, java.io	6	20
	EXCEPTION HANDLING AND MULTITHREADING		
3	Concepts of exception handling, benefits of exception handling, Termination , exception hierarchy, usage of try, catch, throw, throws and finally, creating own exception sub classes. Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, inter thread communication, daemon thread.	8	25

	AWT AND SWING		
4	Introduction to AWT, limitations of AWT, MVC architecture, components, containers, exploring swing Comparison between AWT and Swing.	6	15
	EVENT HANDLING		
5	Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels ,scrollpane, dialogs, menubar, graphics, layout manager , layout manager types – Flow, Border, Grid, GridBag and Card layout	5	15
	Total	**40**	**100**

References:

1. The complete Reference Java SE 8 ,Patrick Naughton, Herbert Schildt.
2. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, seventh Edition,Pearson Education
3. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John Wiley & sons.
4. An Introduction to OOP, second edition, T. Budd, Pearson education.
5. Introduction to Java programming 6th edition, Y. Daniel Liang, Pearson education.
6. An introduction to Java programming and object oriented application development, R.A. Johnson-Thomson.

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MCA2203 OPERATING SYSTEMS
SSMCA – I

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Programming Concepts, Microprocessor Concepts
Objectives: Students should be able to understand the functioning of operating systems and evaluate critically their suitability in a given environment. They will be able to understand how Resources of the Computer are managed internally by Operating Systems. They should be able to observe the impact of Operating Systems when developing Application Software.
Outcome: Students will learn about Operating systems concepts and also how different algorithms are applied for different types of Resource Management of Computer.

Sr. No.	Topic	No. of Lectures	Weightage in %
	OVERVIEW OF SYSTEM SOFTWARE AND OPERATING SYSTEMS		
1	Development of operating system. History of evolution from monolithic systems to layered systems, resident monitors to multiuser, multitasking systems. Types of operating systems, Concepts of Multitasking, Multiprocessing, Multiuser and Multithreading	4	5
	Operating Systems Concepts		
2	Operating System objectives and environment. Operating systems and user interface, Operating system views of System Programmers and Users, Functions of an operating system	4	5
	Process Management		
3	Process management functions in a single process and multiprocess environment. Process model and state transitions. Process scheduling, Multithreading	8	20
	Concurrency Management		
4	Mutual Exclusion, Semaphores Monitors, Inter-process communication and synchronization, Messaging, Race conditions and deadlocks - Issues and solutions.	7	20
	Memory Management		
5	Contiguous and non-contiguous allocation, Static and Dynamic Partitioning, Segmentation, Paging Virtual memory management, Instruction interruptability in virtual memory. Different data structures used for memory management.	8	25
	File Management		
6	File information management and file systems. File system functions. Directory organizations. Space management of file system, Chaining, Indexing	6	15

	Student Assignment		
7	Case Study of an Operating System	3	10
	Total	**40**	**100**

REFERENCES

1. Operating Systems-Concept and Design: Milan Milenkovic
2. Operating System Concepts: Peter Galvin and Silberschatz
3. Operating Systems Design and Implementation: Andrew Tannenbaum
4. Operating Systems-Internals and Design Principles: William Stallings
5. Operating Systems Principles: Hansen Per Brinch
6. Design of the UNIX Operating system: Bach M
7. Operating Systems: Madnick and Donovan

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MCA2204 PYTHON PROGRAMMING

SSMCA-I

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Students should have an understanding of the basic programming skills.
Objectives: Python is a modern language useful for writing compact codes specifically for programming in the area of Server side Web development, Data Analytics, AI and scientific computing as well as production tools and game programming. This course covers the basics and advanced Python programming to harness its potential for modern computing requirements.
Outcome: After completing this course students will be able to write programs for various applications using python. They will also be aware about various available libraries that can be helpful while programming

Sr. No.	Topic	No. of Lectures	Weightage in %
	PYTHON PROGRAMMING		
1	**Introduction to Python:** The basic elements of python, installing and working with python, Understanding Python variables, Python basic Operators, Understanding python blocks, statements and comments, type conversion	03	08
2	**Datatypes:** declaring and using numeric data types, using string data type and string operations, list, tuple, set, dictionary, nested statements, indexing, slicing	04	10
3	**Flow Control:** Using if statement, using else statement, elif clause, while loops, for loop, break and continue, pass statement, looping	05	15
4	**Functions:** Python functions, arguments, recursion, anonymous function, lambda function, global, local, non-local, keyword arguments, default parameters, modules, packages	05	15
5	**Files and Exceptions:** Reading from text files, writing to text files, storing complex data in files, pickling, unpickling, shelving, handling exceptions, multiple exceptions, else clause	05	15
6	**Object and Class** Creating classes, methods, objects, using constructors, destructors, attributes, class attributes, static methods, object encapsulation, private attributes, private methods, controlling attribute access, inheritance, types of inheritance in python, understanding polymorphism, importing modules & classes,	08	20

	operator overloading, iterators, generators		
7	**GUI Developments:** Using a root window, labels, buttons, creating a GUI using a class, binding widgets, event handling, grid layout manager, check button, radio button, tkinter module	06	12
8	**Standard Libraries:** Operating system interface, file wildcards, command line arguments, string pattern matching, mathematics, internet access, date and time, data compression, performance measurement	04	05
	Total	**40**	**100**

References:

1. Introduction to Computation and Programming Using Python by John V Guttag, Prentice Hall of India
2. Core Python Programming by R. Nageswara Rao, dreamtech
3. Core Python Programming by Wesley J. Chun, Prentice Hall
4. Data Structures and Algorithms in Pyhon by Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Wiley
5. Fundamentals of Python –First Programs by Kenneth A. Lambert, Cenagepublication
6. Luke Sneeringer, “Professional Python”, Wrox

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MCA2205 ARTIFICIAL INTELLIGENCE (ELECTIVE-I)
SS MCA– I

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Objective: Artificial intelligence is the science that studies and develops methods of making computers more intelligent. The focus of this course is on core AI techniques for knowledge representation, search, reasoning, learning and designing intelligent systems. The course also aims to give an overview of other topics within AI and learn : Representation of world knowledge using symbolic logic. Deductive strategies employed in symbolic logic. Programming in prolog.

Outcome: After completing this course, students should be able to: Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem. Formalise a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).Design and perform an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports.

Sr. No.	Topic	No. of Lectures	Weightage %
1	Facts, Questions, Variables, Conjunctions, Rules, Syntax, Characters, Operators, Equality and Matching Arithmetic	6	14
2	Structures and Trees, Lists, Recursive Search, Mapping Recursive Comparison, Joining Structure together, Accumulators, Different Structures	3	08
3	Generating multiple solutions, The Cut, Common uses of the Cut, Preventing backtracking, Negation and Failure, Problems with the Cut. Reading and Writing Terms, Reading and Writing Files, Declaring Operators. Entering new clauses, Success and Failure, Classifying Terms	4	11
4	Treating clauses as Terms, Constructing and accessing components of structures, Affecting backtracking, Constructing Compound Goals, Equality, Input & Output, Handling Files, Evaluating Arithmetic Expressions, Comparing Numbers, Watching PROLOG at work	4	11
5	Operations on Data Structures, Representing and Sorting lists, List Processing, Representing Sets by Binary Trees, Insertion and Deletion in Binary Dictionary, Displaying Trees, Graphs.	5	12
6	Brief Introduction to Predicate Calculus and Horn Clauses. Declarative and Procedural meaning of PROLOG programs	3	08
7	Introduction to Artificial Intelligence, representing knowledge using facts and rules Expert System , Natural Language processing, Speech generation and Speech Synthesis	5	12
8	Problems, State Space and Search, Tree Representation, Search Strategies, Depth first Breadth first Best first, heuristic	5	12

	search, Pattern Matching, generate and test, , procedural vs declarative knowledge, forward vs backward reasoning,		
9	Quantifying uncertainty, basic probability notations, probabilistic reasoning, representing knowledge in an uncertain domain, time and uncertainty, minimax, alpha-beta cut-off, refinements, iterative deepening,	5	12
	Total Lectures	**40**	

References:

1. Artificial Intelligence - Elaine Rich, Kevin Knight
2. Introduction of Artificial Intelligence - Charniak E.
3. Artificial Intelligence - Hunt E. D.
4. Understanding Artificial Intelligence - Henry C Mishkoff
5. Programming in PROLOG - W F Clockcin & C S Mellish
6. Prolog Programming for Artificial Intelligence - Ivan Bratko

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MCA2206 DATA SCIENCE AND APPLICATIONS (ELECTIVE-I)
SS MCA – I

Theory	: 3 Lectures	Marks (Theory)	: 100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	: 50
Practical	: 2 Hrs.	Total	: 150

Prerequisites: Familiarity with Math and statistics. Know the Basic concepts of object oriented programming like C, C++ or Java to ease the process of learning data science programming tools like Python and R.Having knowledge of SQL.Curious about playing with data

Objectives: This course will cover how student can gain knowledge in statistical thinking in designing data collection, derive insights from visualizing data, obtain supporting evidence for data-based decisions and construct models for predicting future trends from data.

Outcome: Data collection, analysis and inference.Data classification to identify key traits and customers.Conditional Probability-How to judge the probability of an event, based on certain conditions.How to use Bayesian modelling and inference for forecasting and studying public opinion.Basics of Linear Regression.Data Visualization: How to create use data to create compelling graphic.

Sr. No.	Topic	No. of Lectures	Weightage in %
1.	**Introduction to Data Science**	2	5
2.	**Statistical Thinking 1:** ● Examples of Statistical Thinking ● Basics of Statistics ● Frequency Distributions ● Different Types of Biases ● Numerical Measures of Data ● Probability and Probability Distributions ● Conditional Probability and Bayes Rule	20	50
3.	**Statistical Thinking 2:** ● Samples ● Sampling Methods and CLT ● Hypothesis Testing and testing techniques ● Chi-Square Testing ● Introduction to Linear Regression and Correlation ● Special Regression Models	12	30
4.	**Exploratory Data Analysis and Visualization:** ● Time Series analysis and Forecasting ● Bayesian inference: combining models and data in a forecasting problem	4	10

	● Bayesian hierarchical modeling for studying public opinion ● Bayesian modeling for Big Data		
5.	**Introduction to Machine Learning**	2	5
	Total	**40**	**100**

References:

1. Larry Wasserman's- All of Statistics: A Concise Course in Statistical Inference
2. Hastie, Tibshirani, and Friedman's -The Elements of Statistical Learning
3. David Barber's -Bayesian Reasoning and Machine Learning
4. Statistics for Data Science: Leverage the power of statistics for Data Analysis, Classification, Regression, Machine Learning, and Neural Networks by James D. Miller.
5. Practical Statistics for Data Scientists: 50 Essential Concepts by Peter Bruce , Andrew Bruce

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MCA2207 LINUX ADMINISTRATION AND NETWORK PROGRAMMING (ELETIVE-I)
SSMCA– I

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Students should have an understanding of the basic system programming. Also the student is expected to be familiar with core concepts of operating systems and computer networks**.**

Objectives: Linux is the operating system (OS) of choice for today's servers, network infrastructure, embedded systems and mobile devices. This course offers learning at all levels, from basic installation and tools to network administration, developing applications or services, kernel customization for advanced systems, creating and managing network infrastructure.

Outcome: After the completion of this course, students will be able to Install and administer network services, Use the command line interface for system administration, Install and manage disks and file systems and demonstrate strategies for planning/designing systems.

Sr. No.	Topic	No. of Lectures	Weightage in %
	LINUX ADMINISTRATION		
1	**Introduction:** History, evolution, design principles, system administrators role, root account	2	06
2	**Kernel:** Kernel basics, kernel architecture, compiling the kernel, modules, kernel tuning	3	08
3	**Resource Management:** Package Management: managing packages, compiling programs from source, shared libraries Process Management: process, signals, daemons, memory, process accounting Disk Management: files and directories, file systems, disk quotas, kernel file cache, distributed file system, RAID User Management: users and groups, passwords, removing a user, restrictions, logging in to linux	8	15
4	**Scheduling Tasks and Managing Backups:** Backup and restore, backup media, backup utilities	2	04
5	**Types of Servers & Server Setup in Linux:** File/FTP server, network server, mail server, web server, samba server, telnet server installation, setup and configuration, comparisons of various distributions	3	07
6	**Security:**	2	10

	Host security, vulnerabilities, network security, security policies, internet security resources, encryption, security tools, system logs, managing logs		
	NETWORK PROGRAMMING		
7	**TCP/IP Networking:** Networking roadmap, packet addressing, IP addresses, routing, ARP, DHCP, security issues, basic network configuration	4	08
8	**Network Hardware:** Ethernet, wireless, network testing and debugging, network design issues	6	12
9	**Network File System:** Introduction, server-side NFS, client-side NFS, network information system	3	10
10	**Network Management and Debugging:** Network troubleshooting, packet sniffing, network management protocols, network management applications, NETFLOW	4	10
11	**Security:** How security is compromised, security philosophy, passwords and user accounts, effective use of chroot, security power tools, cryptographic security tools, firewalls, virtual private networks, certification and standards	3	10
	Total	**40**	08

References:

1. Unix and Linux System Administration Handbook by Evi Nemeth, Garth Snyder, Trent Hein, Ben, Whaley, Prentice Hall
2. Unix Network Programming By W. Richard Stevens, Bill Fenner, Andrew M. Rudoff
3. Linux Administration A Beginner's Guide by Wale Soyinka
4. Linux System Administration, By Paul Cobbaut
5. Operating System Concepts & Design : William Stallings, Unix : Sumitabha Das
6. Design of UNIX Operating Systems: Bach M.
7. Operating Systems Design & Implementation : Andrew S. Tanenbaum

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MCA2208 NETWORK SECURITY (ELECTIVE-I)
SSMCA-I

Theory	: 3 Lectures	Marks (Theory)	: 100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	: 50
Practical	: 2 Hrs.	Total	: 150

Objectives: -The subject focuses on basic concepts in Network Security. It aims to introduce the students to the fundamental techniques used in implementing secure network communications, and to give an understanding of common threats and attacks, and some practical experience in protecting network systems and personal data.

Outcome: At the end of this course students will have sufficient knowledge about what is required to secure a Personal System, an Organizational network and also Application data. They will be familiar with some of the good practices to be followed for keeping personal information secure.

Sr. No.	Topic	No. of Lectures	Weightage in %
1	Introduction to Network Security	2	5
2	Security Attacks & Measures : Concepts & Terminologies	2	5
3	Cryptography – Symmetric Key Cryptography and Public Key Cryptography	6	25
4	Message Digests, Digital Signatures, Authentication Systems, Key Management	8	25
5	Network Security Applications : - Electronic Mail Security, IP Security, Web Security, Network Management Security, E-Commerce Security etc.	12	15
6	Hacking & System Security – Intrusion Detection Systems, Malicious Software, Firewalls, VPN, etc	6	25
	Total	**40**	**100**

References:

1. Cryptgraphy&NetworkSecurity :William Stallings
2. Cryptgraphy&NetworkSecurity :Forouzan

MCA-II

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MCA2301 .NET TECHNOLOGIES

FSMCA - II

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Studentshave already studied structured programming and object oriented programming using C and C++, respectively.
Objectives: To teach the fundamentals of windows-based and web programming of .NET using Visual basic and C# along with ASP.
Outcome: Students will be able to write the programs related to windows and web based systems.

Sr. No.	Topic	No. of lecture required	Weightage %
1	An Overview of .NET & its goal - Introduction to .NET - The role of .NET Enterprise Servers - Origins of .NET - An overview of .NET Framework and .NET Core	2	5
2	The .NET Framework's Common Language Runtime (CLR) - The Anatomy of .NET Application - Common Type System - Metadata - Managed Data – Assemblies - Compiling Managed Code - Organising Managed Code - Executing Managed Code Introduction to .NET Core – Understanding .NET Core -Differences between .Net Core and .NET Framework	6	10
3	C# Language – DataTypes, Console I/O, Anatomy of C# Program, Program Control Statements, Understanding Arrays and Strings, OOPs Concepts implementation in C#, Exception Handling, Delegates, Lambda Expressions, Linq and other language features	7	15
4	Class Library (FCL/Core FX) - System Namespaces - System. Collections - Input Output – Windows GUI based (desktop) applications (Introduction)	5	10
5	Threads –Serialization - Working with XML\JSON – Reflection.	2	5
6	Building Web Applications using .NET Technologies ASP.NET Core Based Web Application, MVC, Controllers and Action Methods, Views, Helpers, Model Binding, Validations and Data Annotations, Security, Routing, AJAX Introduction to containerized applications with .NET	8	25

7	Session Management Techniques,ADO.NET Fundamentals, Entity Framework Core	4	10
8	.NET Remoting (Introduction)– Interoperability - Web Services –Web API (Concepts and Implementation)	6	20
	Total Lectures	**40**	

References:

1. Understanding .NET- David Chappell
2. Microsoft Visual C# Step by Step, Ninth Edition, John Sharp, June 2018
3. Programming ASP.NET Core, Dino Esposito, Microsoft Press, May 2018
4. ASP.NET Core fundamentals | Microsoft Docs

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MCA2302 COMPUTER GRAPHICS

FSMCA – II

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	:150

Objective: Understanding the fundamental graphical operation and the implementation on a computer. The mathematics behind computer graphics.This course will introduce students to all aspects of computer graphics including hardware, software and applications.Students will gain experience by completing several programming projects.

Outcome: At the end of this course students should :Have a basic understanding of the core concepts of computer graphics. Be capable of creating interactive computer graphics and understand a typical graphics pipeline. The students will be able to describe the fundamentals of raster graphics, vector graphics and interactive graphics. To apply the algorithms to draw lines, circles, polygons and text. To describe file structure of display & graphics file formats. To scale, rotate and translate the object using transformation techniques. To select and enlarge visible portion of drawing using clipping methods. To develop the logic for drawing the natural objects using different algorithms for curved lines.

Sr. No.	Topic	No. of Lectures	Weightage %
1	Geometry & Line Generation : Lines, Vector Generation, Bresenham's Algorithms, DDA, Character Generation etc.	5	12
2	Graphics Primitive :Display devices, primitive operations, display-file interpreter, normalized device co-ordinates, display-file structure, display-file algorithms etc.	6	15
3	Polygons :Polygon representation, algorithms, initialization, antialiasing, Scan conversion – Generation, Display, Real Time onversion, Run-Length, Cell-Enoding, Polygon Filling-Scanconverting, Seed Fill, etc.	6	15
4	Transformations :Matrices, Scaling transformations, rotation, homogeneous co-ordinates and translation, other transformations, display procedures etc. .Three Dimensions: 3D Geometry, 3D Primitives, 3D Transformations, Rotation about an arbitrary axis, parallel projection, perspective projection.	6	15
5	Segments :The segment table, segment creation, closing/deleting/renaming a segment, some raster techniques etc.	4	10
6	Windowing &Clipping :The Viewing transformation, clipping, the Cohen-Sutherland Outcode Algorithm, Clipping of polygons, generalized clipping, multiple windowing etc. Hidden Surfaces & Lines :Back - Face removal back-face algorithms, Z - buffers, Scanline algorithms, the painter's algorithm, comparision techniques, hidden-line methods, binary space partition etc.	5	13

7	Interaction :Hardware, Input device handling algorithms, event handling, sampled devices, the detectability attribute, simulating a locator with a pick a vice-versa, echoing etc.	4	10
8	Curves & Fractals: Curve Generation, interpolation, interpolating algorithms, polygons, fractal lines, fractal surfaces etc.	4	10
	Total Lectures	**40**	**100**

References:

1 Computer Graphics (A programming Approach) by Steven Harrington
2 Procedural Elements for Computer Graphics by David F Rogers
3 Mathematical Elements for Computer Graphics by David F Rogers
4 Computer Graphics (Principle & Practice) by Foley & Van Dam
5 Computer Graphics by Hearn & Baker
6 Principals of Interactive Computer Graphics by William M Newman, Robert F Sproull
7 Fundamentals of Interactive Computer Graphics by J D Foley, A Van Dam

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
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MCA2303 SOFTWARE ENGINEERING
FSMCA – II

Theory	: 3 Lectures	Marks (Theory)	: 100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	: -
Practical	: -	Total	: 100

Prerequisites: Students should have an understanding of the basic programming. This course aims to enable students to understand the requirement of customers and how to design a plan before implementation.
Objectives: This is to provide student basic understanding of software product, software design and development process, software project management and design complexities etc. At the end of the student will be equipped with well understanding of software engineering concepts..
Outcome: Student will develop analytical skills to evaluate software and make improvements.Compile bugs into reports and recommend solutions. Effective professional communication skills. Detail oriented approach to software design. Creative minded professional. Extensive problem solving and critical thinking abilities. Excellent understanding of design principles and experience in their application. Background in quality assurance department. Extensive working knowledge of hardware, tools, and software languages. Ability to design and develop technical plans. Logical and structured way of interpreting information.

Sr. No.	Topic	No. of Lectures	Weightage in %
1.	**Fundamental of Software Engineering:** ● Introduction to Software Engineering. Basic issues in Software Engineering-Structural Programming. ● Software Development Life Cycle, Basics of Software life cycle-Waterfall model-Prototype and Spiral models. ● Requirement Analysis and Specification, Basic concepts in requirement analysis and specification-Formal Requirement specification-Algebraic Specification.	10	25
2.	**Basics in Software Design:** ● Software Design, Basics in Software Design-Overview of current design approaches-Function, and Oriented Software Design-DFDs-DFD model of a system-structured design-ER Modeling-Database Design. ● Object Oriented Design and Software Development, Revision of OO concepts-Object modeling using UML-Use Case Models-Class and interaction diagrams-Activity and Statechart diagrams-Sequence and Collaboration diagrams-Component and Deployment diagrams- Design patterns-Domain modeling	10	25

3.	**UI Design & Software Testing:** ● User Interface Design, Basics in UI design-Types of UI-Component based GUI Development. ● Coding and Testing, Code Review-Black Box Testing-White Box Testing-Debugging, Interaction and System Testing. ● Software Project Management, Project Planning and estimation techniques-COCOMO Model-Staffing level estimation and Scheduling-CPM and PERT. ● Software Project Monitoring and Control, Organization and team structures-Risk management and software configuration management	10	25
4.	**Software Reliability & CASE Tools:** ● Software Reliability and quality management, Reliability issues-Statistical testing and Software quality management-ISO9000-SEI CMM. ● Software Maintenance and Reuse, Characteristics of software maintenance-Basics of software reuse-reuse approach. ● Computer Aided Software Engineering (CASE), Basic idea on CASE tools-Characteristics-Case study on CASE tools.	10	25
	Total	**40**	**100**

References:

1. Fundamentals of Software Engineering – Rajib Mall.
2. Software Engineering – A practitioner's Approach by Roger Pressman.
3. Software Engineering – Ian Sommerville

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MCA2304 ADVANCE COMPUTING TECHNOLOGIES (ELECTIVE-II)
FS MCA– II

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Basics of Computer Architecture and Organization, Networking, Distributed Database.

Objectives: This course covers the fundamental ideas behind Cloud, Fog and edge Computing, the evolution of the paradigm with its applicability.

Outcome: Upon successful completion of this course, Students will be able to explain the core concepts of the cloud, fog and edge computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in these environments.

Sr. No.	Topic	No. of Lectures	Weightage in %
	INTRODUCTION TO CLOUD COMPUTING		
1	Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models, Service models, Cloud Reference model, Characteristics of Cloud Computing, Benefits and advantages of Cloud Computing; Cloud Architecture: A brief introduction on Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients; Services and Applications by Type: IaaS, PaaS, SaaS, IDaaS and CaaS.	6	10
	USE OF PLATFORMS IN CLOUD COMPUTING		
2	Concepts of Abstraction and Virtualization: Virtualization technologies, Load Balancing and Virtualization, Hypervisors, Machine Imaging, Porting of applications in the Cloud; Concepts of Platform as a Service; Use of PaaS Application frameworks; Use of Google, Amazon and Microsoft Web Services;	6	10
	CLOUD INFRASTRUCTURE CLOUD MANAGEMENT		
3	Features of network management systems, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle); Cloud Security: Cloud security concerns, Security boundary, Security service boundary, Overview of security mapping, Security of data, Identity management.	6	20

	CONCEPTS OF SERVICES AND APPLICATIONS		
4	Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs; Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs; Cloud-based Storage: Cloud storage definition – Manned and Unmanned; Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail.	8	20
	FOG AND EDGE COMPUTING		
5	Completing the Cloud, Advantages of FEC: SCALE, How FEC Achieves, These Advantages: SCANC, Hierarchy of Fog and Edge Computing, Addressing the Challenges in Federating Edge Resources.	8	10
6	Optimization Problems in Fog and Edge Computing, Middleware for Fog and Edge Computing: Design Issues. Data Management in Fog Computing, Applications and Issues.	6	10
	Total	**40**	**100**

References:

1. Cloud Computing Bible by B. Sosinsky, Wiley India
2. Mastering Cloud Computing by R. Buyya, C. Vecchiola and S. T. Selvi, McGraw Hill
3. Cloud computing: A practical approach by A. T. Velte, TMH
4. Cloud Computing by Miller, Pearson
5. Building applications in cloud: Concept, Patterns and Projects by Moyer, Pearson
6. Fog and Edge Computing: Principles and Paradigms by Rajkumar

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
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MCA2305 DATA MINING & DATA WAREHOUSING (ELECTIVE-II)
FSMCA – II

Theory	: 3 Lectures	Marks (Theory)	: 100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	: 50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites:

- An introductory course on database systems
- Basic concepts in probability and statistics

Objectives: - This course will introduce the concepts, techniques, design and applications of data warehousing and data mining. Some systems for data warehousing and/or data mining will also be introduced. The course is expected to enable students to understand and implement classical algorithms in data mining and data warehousing. Students will learn how to analyze the data, identify the problems, and choose the relevant algorithms to apply. Then, they will be able to assess the strengths and weaknesses of the algorithms and analyze their behavior on real datasets.

Outcome: By the end of this course the student should be able to:

- Understand the functionality of the various data mining and data warehousing components
- Appreciate the strengths and limitations of various data mining and data warehousing models
- Compare the various approaches to data warehousing and data mining implementations
- Describe and utilize a range of techniques for designing data warehousing and data mining systems for real-world applications

Sr. No.	Topic	No. of Lectures	Weightage in %
	DATA WAREHOUSING		
1	Introduction to data warehousing- evolution of decision support systems- Modeling a data warehouse- granularity in the data warehouse- Data warehouse life cycle- building a data warehouse-Data Warehousing Components- Data Warehousing Architecture- Data Warehouses and Data Marts	5	15%
2	**ONLINE ANALYTICAL PROCESSING** On Line Analytical Processing, Multidimensional Data Model – OLAP Guidelines, Multidimensional versus Multirelational OLAP, Categorization of OLAP Tools	3	10%
	DATA MINING		
3	Motivation for Data Mining – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues in DM, KDD process.	3	10%
4	**DATA PREPROCESSING AND DATA MINING PRIMITIVES**	5	13%

	Why Preprocess the Data? – Data Cleaning – Data Integration and Transformation – Data Reduction – Discretization and Concept Hierarchy Generation – Data Mining Primitives: What Defines a Data Mining Task?		
5	**CONCEPT DESCRIPTION** What is concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons	3	5%
6	**ASSOCIATION RULE MINING AND CLASSIFICATION** Association Rule Mining: Market basket analysis - basic concepts ,Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – improved Apriori algorithm – Incremental ARM – Associative Classification – Rule Mining	5	12%
7	**CLASSIFICATION** Classification and Prediction - Basic Concepts - Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.	6	15%
8	**CLUSTERING AND TRENDS IN DATA MINING** Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.	6	15%
9	**ADVANCE TOPICS OF DATA MINING AND ITS** APPLICATIONS Mining Time-Series and Sequence Data – Mining Text Databases – Mining the World Wide Web – Data Mining Application	4	5%
	Total	**40**	**100**

References:

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Second Edition, 2006
2. Alex Berson,Stephen J. Smith, "Data Warehousing, Data Mining, & OLAP", Tata Mcgraw-Hill, 2004.
3. Introduction to Data Mining. Tan, Steinbach, Kumar. Addison-Wesley. 2006.
4. W. H. Inmon, "Building the Data Warehouse", 3rd edition.
5. Anahory and Murray .,Data warehousing in the real world , Pearson Education/Addison Wesley.
6. Margaret Dunham, Data Mining: Introductory and Advanced Topics, Published by Prentice Hall.
7. George M Marakas, Modern Data Warehousing , Mining

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
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THE M. S. UNIVERSITY OF BARODA

MCA2306 INFORMATION SECURITY (ELECTIVE-II)
FSMCA-II

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	: 50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Sufficient knowledge of cryptography.

Objectives:

1. To assess the current security landscape, including the nature of the threat, the general status of common vulnerabilities, and the likely consequences of security failures at network, server and application levels in CIA triad.
2. To justify the need for appropriate strategies and processes for disaster recovery and fault tolerance and propose how to implement them successfully.
3. To understand use of cryptography to maintain information confidentiality and integrity.

Outcome: Students will be able to :

1. Identify various vulnerabilities of computers network systems as well as the different modes of attack.
2. Explore and design techniques to prevent security attacks.
3. Identify the security solutions for servers like DNS, DHCP, WINS, Remote Access, NAT.
4. Explore the emerging security solutions for Web and Email using Firewall, SSL, TLS, SET and IPSec.
5. Develop the disaster recovery and fault tolerance systems.
6. Identify the need of information auditing, forensics security.

Sr. No.	Topic	No. of lecture required	Weightage %
1	Information Security Fundamentals	6	15%
2	Cryptography (symmetric and asymmetric, hashing, signatures, etc.) &Network Security	6	15%
3	Server Security	5	12.5%
4	Application Security	4	10%
5	Disaster Planning and Risk Management	6	15%
6	Access Control	6	15%
7	Information Auditing, Forensics Security and Assurance	4	10%
8	Web security	3	7.5%
		40	

References:

1.Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings, Pearson
2. Information Security Principles and Practice By Mark Stamp, Willy India Edition
3. Cryptography & Network Security, Forouzan, Mukhopadhyay, McGrawHill
4. Cryptography and Network Security Atul Kahate, TMH
5. Cryptography and Security, C K Shyamala, N Harini, T R Padmanabhan, Wiley-India
6. Information Systems Security, Godbole, Wiley-India
7.Peltier, Thomas R. Information Security Fundamentals. 2nd ed. CRC Press. Boca Raton, FL: Auerbach Publications, 2014. (ISBN No.: 978-1-4398-1063-7) (R1)
8. Vacca, John R., ed. Network and System Security. United States: Syngress Media,U.S., 2010. (ISBN No. : 978-1-59749-535-6) (R2)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
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MCA2307 INTERNET OF THINGS (ELECTIVE-II)
FS MCA– II

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Students should have an understanding of the basic programming.
Objectives: This course covers the fundamentals of Internet of Things, IOT protocols and also helps to build a small low cost embedded system using Raspberry Pi. And also to apply the concept of Internet of Things in the real world scenario
Outcome: Upon completion of this students should be able to: Analyze various protocols for IoT, Develop web services to access/control IoT devices, Design a portable IoT using Rasperry Pi, Deploy an IoT application and connect to the cloud and Analyze applications of IoT in real time scenario.

Sr. No.	Topic	No. of Lectures	Weightage in %
	INTRODUCTION		
1	IOT Architecture and different layers: Physical, Computing, Communication, Management etc.Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.	4	10
	PLATFORM		
2	Open-source prototyping platforms. BasicArduino programming; Extended Arduino libraries; Arduino-based Internet communication; Raspberry pi; Sensors and Interfacing: Temperature, Pressure, Humidity, etc.	10	15
	PROTOCOLS		
3	RFID; Zigbee; IEEE 802.15.4e; ISA200.11a; Wireless HART; MiWi; Thread; 6LoWPAN; RPL;Constrained Application Protocol (CoAP); ExtensibleMessaging Protocol (XMPP) WebSocket; Advanced Message Queuing Protocol (AMQP); Message Queue Telemetry Transport (MQTT); Web Real Time Communications (WebRTC).	10	25
	OPERATING SYSTEM		
4	Various aspects of operating systems designed for the IoT environment; open source OS for IoT like TinyOS etc	4	10
	SECURITY AND PRIVACY ASPECTS		
5	Security architecture of IoT; Security threats; Security initiatives towards Iota	4	5
	IOT STACK		
6	IoT devices and connected physical things, Stack of IoT, IoT devices: sensors, actuators,Gateways,Platforms.	3	10
	IOT TOOLS		

7	Contiki ,cooja,Zeeta,	2	5
	APPLICATION SCENARIO		
8	Home Networking, Automotive Networks ,Industrial Networks, Interactive Toys, Remote Metering.	3	20
	Total	**40**	**100**

References:

1. Olivier Hersent, David Boswarthick, and Omar Elloumi, “The Internet of Things: Key
2. Applications and Protocols Paperback” – 25 Aug 2015 Wiley Press
3. ArshdeepBahga and Vijay Madisetti, “Internet of Things: A Hands-on Approach” (Paperback – 1 Jul 2015), Universities Press
4. CunoPfister, “Getting Started with the Internet of Things” (Paperback – 17 May 2011), O’Reilly.
5. Designing the Internet of Things (Paperback – 25 Jul 2015).
6. Massimo Banzi, “Getting Started with Arduino (Make: Projects)”, O'Reilly Media. 2008

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MCA2308 WEB TECHNOLOGIES & PROGRAMMING (ELECTIVE-II)
FSMCA – II

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Fundamentals of Programming and Networking
Objectives: This Subject is useful for Making own Web page and how to host own web site on internet. The subject covers the wide range of web technologies both client side and server side to provide the exposure to the students to develop Rich Internet Applications using them. It covers the basics WWW, client side technologies like HTML, CSS and DHTML including JavaScript.
Outcome: Upon successful completion of this course, the student will be able to Plan, design, create, and implement a website. Student will learn the concept of XML, CSS and DHTML. The student will be able to Develop a static and dynamic websites, establish the database connectivity over a website**.**

Sr. No.	Topic	No. of Lectures	Weightage in %
	INTRODUCTION TO HTML		
1	Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, Browser architecture and Web site structure, Overview and features of HTML5, Graphics tags, Media Tags, HTML API's.	5	10
	STYLE SHEETS, USER EXPERIENCE DESIGN		
2	Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, Overview and features of CSS3, CSS and Layouts, Responsive Webpage design, Work Flow for designing a web site User Experience Principles, Design Principles.	7	15
	XML		
3	Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX, XSLT,DTD, XML Schema, XML Parsers.	5	15
	JAVASCRIPT AND AJAX		
4	Introduction, HTTP request AND HTTP Methods, JavaScript, JavaScript Events, DOM, JQuery, using and Integrating JavaScript Functionality, JQuery widgets, XMHttpRequest, Introduction to AJAX, Implementing AJAX in Web Pages, JSON	6	20
	INTRODUCTION TO FRONT END FRAMEWORK AND WEBSERVICES		

5	Web Application Security, Web Page Performance, Introduction to Angular JS, Node JS, React JS or Current JS Framework , Using any one framework in websites ,Introduction to Web Services, Protocols used in Web Services SOAP,WSDL,REST and current standards and practices, Implementing Cross Language Web Services	10	20
	WEB SECURITY		
6	Web Security Principles and attacks, Payment processing mechanisms, Digital Certificates, Digital Signatures, SSL, TLS, SET, Electronic Money, Electronic Data Interchange, Introduction to middleware and component Technologies(CORBA, RMI,DCOM).	7	20
	Total	**40**	**100**

References:

1. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India
2. HTML 5, Black Book, dreamtech Press.
3. Developing Web Applications in PHP and AJAX, Harwani, McGrawHill.
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson.
5. Web Technologies by Atul Kahate and Achyut Godbole, Tata McGraw Hill.
6. An Introduction to XML and Web Services, Anders Moller, Michael Schwartzbach , Addison Wesley Professional.

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MCA2309 ADVANCED JAVA TECHNOLOGIES (ELECTIVE-III)
FS MCA– II

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Basics Object Oriented Concepts, Core Java Programming, Operating Systems, Database Systems and Computer Networks.
Objectives: This subject aims at teaching the evolution of Application Programming, Issues and Challenges related to design and implementation Network based Applications, Client-Server Applications, Web-based Applications and Distributed Applications. It enables the student to develop n-tier architecture based application programming.
Outcome: Students will learn about application development for Network, Client-Server, Web-based, Distributed Applications, implemented in optimized way using various Design Patterns.

Sr. No.	Topic	No. of Lectures	Weightage in %
1	**A REVIEW TO CORE JAVA CONCEPTS**		
	Introduction to Java 8, Lambda expressions, Method references ,Functional interfaces, Stream API, Default methods, Static methods in interface, Optional class, Collectors class, For Each() method, Annotations ,Parallel array sorting.	6	10
2	**GUI Pragramming, Event Handling & JAVA Swings**		
	Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window SWING Lists, Trees, Tables, Styled Text Components, Progress Indicators, Component Organizers, Extending GUI Features Using Swing Components, Introduction to JApplet Class	6	20
3	**Java Networking**		
	Concepts and APIs for IP Address, URL, ServerSocket, Socket, Datagram Socket, Socket Programming, UDP Programming, Multicasting, Concepts of Chat Server and Proxy Server and its implementation issues.	3	10
4	**Java Database Connectivity**		
	The Design of JDBC. The Structured Query Language, JDBC	4	10

	Installation, Basic JDBC Programming Concepts, Query Execution, Scrollable and Updatable Result Sets, Metadata, Row Sets, Transactions, Advanced Connection Management, Introduction of LDAP		
5	**Java RMI**		
	Concepts of Distributed Systems, Characteristics of Distributed Systems, RPC concepts, Purpose of RMI, RMI implementation using Stub and Skeleton, Naming Interface and RMI classes, Programming using RMI	4	10
6	**Java Servlets & JSP**		
	Concepts of Web-based Application Development, Difference between CGI and Servlets, Generic and HTTP Servlets, Programming and Executing the Servlet programs, Servlet Request and Servlet Response, Passing Parameters from Client to Servlets, Passing Initialization Parameters to Servlets, Accessing Request Information, Cookies and Session Handling, Database Communication from Servlets, Request Dispatcher, invoking another Servlet, Uploading and Downloading files using Servlets, HTTP Filter. Introduction to JSP, Difference between JSP and Servlets, Setting Up the JSP Environment, JSP Directives, JSP Action, JSP Implicit Objects, JSP Form Processing, Standard Tag Libraries, JSP Custom Tag, JSP Expression Language (UEL), JSP Exception Handling, JSP XML Processing, Annotations	8	20
7	**Java Mail, Web Services, REST APIs, Java Security APIs, JNLP, JMC**		
	Java Mail Environment Setup, Java Mail APIs, Sending, Receiving, Forwarding, Replying, Deleting Mails What is a Web Service, Components of Web Service, SOAP Web Service, RESTful Web Service, Comparison of SOAP & REST, Web Service APIs Concepts of javax.security package and its fundamental classes, Implementing Security through JNLP, Java Mission Control	6	10
8	**Design Patterns, Java Application Development Frameworks and Tools, Introduction to Hibernate, Introduction to JSF**		
	Concepts and Purpose of Design Patterns, Types of Java Design Patterns like Creational Patterns, Structural Patterns and Behavioral Patterns	3	10
	Total	**40**	**100**

REFERENCES

1. Sun Microsystems Press Java Series vol1 & 2 – Peter van der LINDEN
2. Java Programming Language – Ken Arnold, James Gosling, David Holmes, Sun Microsystems
3. Java Network Programming – Elliotte Harold, O'Reilly
4. Java Servlets and JSP – Marty Hall, Sun Microsystems
5. Headfirst Servlets and JSP – Bryan Basham, Kathy Sierra, Bert Bates, O'Reilly
6. A Programmers Guide to Java Certification: A Primer – Khalid Mughal, Pearson Education Inc.
7. Java Web Services Architecture – James McGovern, Sameer Tyagi, Michael Stevens, Sunil Mathews, Elsevier
8. Java Design Patterns – James W. Cooper, Addison-Wesley
9. Java API Reference through Online Java Docs

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MCA2310 BIG DATA ANALYTICS (ELECTIVE-III)
FSMCA – II

Theory	: 3 Lectures	Marks (Theory)	: 100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	: 50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Students Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment

Objectives: - This course will make students to

- Understand the Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Understand Map Reduce Jobs
- Provide hands on Hodoop Eco System
- Apply analytics on Structured, Unstructured Data.
- Exposure to Data Analytics with R.

Outcome: By the end of this course the student should be able to:

- Build and maintain reliable, scalable, distributed systems with Apache Hadoop.
- Write Map-Reduce based Applications
- Design and build MongoDB based Big data Applications and learn MongoDB query language
- Learn difference between conventional SQL query language and NoSQL basic concepts
- Learn tips and tricks for Big Data use cases and solutions.
- Apply Machine Learning Techniques using R.

Sr. No.	Topic	No. of Lectures	Weightage in %
1	INTRODUCTION TO BIG DATA Introduction– distributed file system–Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce	6	10%
2	INTRODUCTION TO HADOOP AND HADOOP ARCHITECTURE Big Data – Apache Hadoop & Hadoop EcoSystem, Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce -, Data Serialization, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets	8	20%
3	HDFS, HIVE AND HIVEQL, HBASE HDFS-Overview, Installation and Shell, Java API; Hive Architecture and Installation, Comparison with Traditional	8	20%

	Database, HiveQL Querying Data, Sorting And Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG, Zookeeper , how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper		
4	Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	4	15%
5	SPARK Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib.	4	10%
6	NoSQL What is it?, Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NewSQL	5	15%
7	Data Base for the Modern Web Introduction to MongoDB key features, Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents , MongoDB Query Language.	5	10%
	Total	**40**	**100**

References:

1. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015. References
2. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
3. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012
4. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
5. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
6. Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
7. Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
8. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
9. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

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MCA2311 MACHINE LEARNING & APPLICATIONS (ELECTIVE-III)
FSMCA-II

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Prerequisites: Familiarity with basic concepts of computer science (algorithms, data structures, and complexity), mathematical maturity commensurate in discrete math, matrix math , probability and statistics , and the ability to program algorithms in a language of your choice (e.g., C++ or Matlab)

Objectives: -This course is intended to introduce some of the basic concepts of machine learning from a mathematically well motivated perspective. This course will cover the different learning paradigms and some of the more popular algorithms and architectures used in each of these paradigms.

Outcome: By the end of the course, students should be able to develop an appreciation for what is involved in learning models from data. Student should be able Understand a wide variety of learning algorithms and how to evaluate models generated from data. Student will be able to apply the algorithms to a real-world problem, optimize the models learned.

Sr. No.	Topic	No. of Lectures	Weightage in %
	INTRODUCTION		
1	Well Posed Learning problems, Designing a Learning System	1	4
2	Perspectives and issues in machine learning, Probability Theory, Linear Algebra, Convex Optimization	4	10
	CONCEPT LEARNING AND THE GENERAL TO SPECIFIC ORDERING		
3	A concept learning task, concept learning as search, Finding a Maximally specific Hypothesis	2	6
4	Version Spaces and the Candidate Elimination Algorithm	1	5
	DECISION TREE LEARNING		
5	Decision Tree Representation, Appropriate problem for Decision Tree Learning	1	5
6	The Basic Decision tree Learning Algorithm, Hypothesis Space Search in Decision tree learning, Inductive Bias in Decision Tree Learning, issues in Decision tree learning	4	10
	Artificial Neural Network		
7	Neural Network representations, appropriate problem for neural network learning	1	5
8	Perceptrons, Multi-layer Network and back propagation algorithm	2	6

	BAYESIAN LEARNING		
9	Bayes theorem and concept learning, Bayes optimal classifier	2	6
10	Native bayes classifier, An Example to learn classifier text.	2	4
	INSTANCE BASED LEARNING		
11	Introduction, k-nearest neighbor learning, distance weighted nearest neighbor learning algorithm	3	5
	GENETIC ALGORITHMS		
12	Introduction of Genetic Algorithms, Hypothesis space search, Genetic Programming, Parallelizing Genetic Algorithms	5	10
	LEARNING SETS OF RULES		
13	Sequential Covering Algorithms, Learning Rule sets, Learning First Order Rules, Learning sets of First Order Rules, FOIL, Induction as Inverted Deduction, inverted Resolution	6	12
	SUPPORT VECTOR MACHINE		
14	Maximum margin linear separators, Quadratic Programming solution to finding maximum margin separators, kernels for learning non-linear functions	6	12
	Total	**40**	**100**

References:

1. Stephen Marsland, Machine Learning: An Algorithmic Perspective.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning.
3. Tom Mitchell, Machine Learning.
4. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman

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THE M. S. UNIVERSITY OF BARODA

MCA2312 MOBILE APPLICATION PROGRAMMING (ELECTIVE-III)
FSMCA – II

Theory	: 3 Lectures	Marks (Theory)	:100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	:50
Practical	: 2 Hrs.	Total	: 150

Pre-requisites: Programming using Java.

Objectives: To teach the fundamentals of Mobile application development using Android

Outcome:

- Understand the concept of open source mobile development.
- Describe Android architecture frame work.
- Design Android UI Layout
- Develop event driven programs.
- Develop applications using menus and dialog boxes.

Sr. No.	Topic	Lectures Required	Weightage %
1	Mobile technology : Overview of Android - An Open Platform for Mobile development, Open Handset Alliance, Use of Android for mobile app development, Android Marketplaces, Android Development Environment setup, Android Studio, Creating & setting up Android emulator, Android Project Framework and its applications	4	10
2	Android Architecture: Linux Kernel, Libraries, Android Runtime, Application Framework, Applications, Android Startup and Zygote, Android Debug bridge, Android Permission model, Android Manifest File	2	5
3	Design Android UI Layout Android application components: Intent, Activity, Activity Lifecycle, Broadcast receivers, Services and Manifest, Create Application and new Activities, Expressions and Flow control, Android Manifest, Simple UI -Layouts and Layout properties, Fundamental Android UI Design, Introducing Layouts, Creating new Layouts, Drawable Resources, Resolution and density independence (px,dp,sp)	8	20
4	Develop event driven Programming in Android: Event driven Programming in Android (Text Edit, Button clicked etc.), Creating a splash screen, Android Activity Lifecycle, Introduction to threads in Android	8	20
5	Develop application with menus and dialog boxes, Menu: Custom Vs. System Menus, Creating and Using Handset menu Button (Hardware), Android Themes, Dialog, create an Alter Dialogue, Toast & SnackBar in Android, List & Adapters, Android Manifest.xml File	8	20

6	Develop applications with database: SQLite: Open Helper and create database, Open and close a database, CRUD operation in database, Introduction to Firebase & database programming	6	15
7	Introduction to OpenCV programming using Android	4	10

Reference Books

1. Professional Android 2 Application Development Reto Meier Wiley India Pvt Ltd
2. Beginning Android Mark L Murphy Wiley India Pvt Ltd
3. Professional Android Sayed Y Hashimi and Satya Komatineni Wiley India Pvt Ltd
4. www.developers.android.com

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MCA2313 MOBILE COMPUTING (ELECTIVE-III)
FSMCA-II

Theory	: 3 Lectures	Marks (Theory)	: 100
Tutorial	: 1 Hr	Marks (Pr/Tw/Viva)	: 50
Practical	: 2 Hrs.	Total	: 150

Objective: The Mobile Computing course is intended to teach students the issues involved in wireless technology and mobile computing

Sr. No.	Topic	No. of lecture required	Weightage %
1	Introduction to mobile communication and computing cellular network, cellular concepts, location management, handoffs	5	5
2	Wireless LANS and application overview WLAN ,Wireless application Mac issues(Hidden and exposed terminals, near and far terminals), Mobile IP, Mobile ad-hoc networks(MANET),TCP issues, Disconnected operations, Data broadcasting, Mobile agent	7	20
3	a.GSM: Air-interface, channel structure, timing, Mobile services(Bearer, Tele-and-supplementary services)System architecture ,Protocols ,Localization and calling Handover ,Value added services ,SMS ,Cell broadcast service ,MMS ,Location services b.WAP :Architecture ,Protocol stack ,Application environment, -application demo	7	20
4	Access technologies :Bluetooth, GPRS, 802.11, CDMA3,Mobile phone Technologies(1G,2G,2.5G,3G)	7	20
5	Database Issues :Hoarding techniques Caching invalidation mechanism ,Client server computing with adaption ,Power aware and context aware computing,Transactional model, query processing recovery and quality of service issues	8	20
6	Introduction to Peer to peer communication :Accessing telephony Hardware ,GTalk ,SMS	3	5
7	Introduction to Cloud computing Definition, cloud architecture, cloud storage Introduction to Enterprise Content Management	3	10
	Total Lectures	**40**	

Reference:

1. Mobile Communications - By Jochen Schiller
2. Mobile Computing - By Asoke Talukdar & Roopa Yavagal