

*Placed at the meeting of
Academic Council
held on 12.12.2019*

Appendix-H-36
MADURAI KAMARAJ UNIVERSITY
(University with Potential for Excellence)

Directorate of Distance Education

Syllabus for M.C.A. (Semester Pattern)
(Master of Computer Application)
(With effect from the academic year 2019-2020 onwards)
Regulations, Scheme of Examinations and Syllabus

I. About the Department : The Department of Computer Science in the Directorate of Distance Education of Madurai Kamaraj University is one of the oldest departments in the Directorate started in late 1970s. The department currently offers both P.G. and U.G programs in Computer Science.

II. Program Overview : The M.C.A. program (Master of Computer Application) at the Directorate is a conventional program focusing on Information Technology. It stresses the development of applied analytic tool skills, advanced cognitive abilities, and topical specialties allowing students to tailor the program to their interest.

III. Objectives of the Program :

1. To prepare the students to manage the software components in a computer independently and to be a Programmer.
2. To motivate the students to take up higher studies in Computer Application and other streams.

IV. Program Target Groups : The Program may be structured in a way to attract aspirants of system programmer, Software industries, Program Analyst, Data –Operator Software development, IT, Banking, Consultancies etc.

V. Program : M.C.A (Master of Computer Application) Duration: 3 Year

Eligibility: Any degree with Mathematics at plus 2 level (Allied subjects like Basic Mathematics,

Applied Mathematics and Business Mathematics are not treated as equivalent to +2 Mathematics)

Eligibility for MCA Lateral Entry : Duration: 2 Year

B.C.A. (or) B.Sc. (Computer Science/Information Technology)

Note: The students have to write all second year and third year papers by year wise and need not write first year papers of the programme. Year exception and first year paper exception is provided.

VI. Degree Overview : M.C.A. Computer Application is a **3 year Postgraduate** program which deals with subjects and topics related to computer application and services. Technological implementation of computer systems is the main agenda of the program. The program ranges widely from creating quality professionals and research fellows who are working in every sector of the world today.

VII. Degree Title: M.C.A. (Master of Computer Application)

VIII. Program Structure : See Appendix–CA1

Semester	Total Hours ()						Total Credits []
I	FS1(4) [4]	CS1(4) [4]	CS2(5) [5]	CS3(5) [3]	18	--	16
II	FS2(4) [4]	ES1(4) [4]	CS4(5) [5]	CS5(5) [3]	18	---	16
III	CS6(4) [4]	ES2(4) [4]	CS7(5) [5]	CS8(5) [3]	18	--	16
IV	CS9(4) [4]	ES3(4) [4]	CS10(5) [5]	CS11(5) [3]	18	---	16
V	CS12(4) [4]	CS13(5) [4]	CS14(5) [5]	CS15(5) [3]	19	EES1(2) [1]	16
VI	EES2 [15]					---	15

Total No. of Hours: 101

Total No. of Credits: 96

Abbreviations :

- () – Number of Hours
- [] – Number of Credits
- FS – Foundation Subject
- CS - Core Subject
- EES - Enhanced Employability Subject
- ES – Elective Subject

I SEMESTER

S No	Code	Subject	Hours	Credits	Internal Marks	External Marks
1	FS1	Mathematical Foundations of Computer Applications	4	4	25	75
2	CS1	Digital Fundamentals and Computer Architecture	4	4	25	75
3	CS2	Problem Solving and Programming in C	5	5	25	75
4	CS3	LAB: Programming in C	5	3	40	60
Total			18	16		

II SEMESTER

S No	Code	Subject	Hours	Credits	Internal Marks	External Marks
1	FS2	Optimization Techniques	4	4	25	75
2	ES01	Machine Learning	4	4	25	75
3	CS4	Object Oriented Programming and Design	5	5	25	75
4	CS5	LAB: Object Oriented Programming using C++	5	3	40	60
Total			18	16		

III SEMESTER

S No	Code	Subject	Hours	Credits	Internal Marks	External Marks
1	CS6	Data Communication and Computer Networks	4	4	25	75
2	ES2	Internet of Things	4	4	25	75
3	CS7	Data Warehousing and Mining	5	5	25	75
4	CS8	LAB: Data Mining	5	3	40	60
Total			18	16		

IV SEMESTER

S No	Code	Subject	Hours	Credits	Internal Marks	External Marks
1	CS9	Software Engineering	4	4	25	75
2	ES3	Big Data Analytics	4	4	25	75
3	CS10	Dot Net	5	5	25	75
4	CS11	LAB: Dot Net	5	3	40	60
5	EES1	Mini Project and Report writing	2	1	40	60
Total			20	17		

V SEMESTER

S No	Code	Subject	Hours	Credits	Internal Marks	External Marks
1	CS12	Information Security	4	4	25	75
2	CS13	Relational Database Management Systems	5	4	25	75
3	CS14	Mobile Computing	5	5	25	75
4	CS15	LAB: Mobile Computing	5	3	40	60
Total			18	16		

VI SEMESTER

S No	Code	Subject	Hours	Credits	Internal Marks	External Marks
1	EES2	Project Work and Viva Voce (Industry / Institutional based)		15	40	60
Total				15		

See Appendix–CA2

Scheme of Examination / Question Paper Pattern I - Theory Subjects:

(Total Marks: 100 (Internal: 25 Marks, External: 75 Marks))

Parameters			
Internal Marks		External Marks	
i.	Average of two tests	10 Marks	i. Part – A (10*1) 10 Marks
ii.	Assignment	05 Marks	ii. Part – B (5*7) 35 Marks
iii.	Seminar/ Group Discussion	05 Marks	iii. Part – C (3*10) 30 Marks
iv.	Peer-team-Teaching	05 Marks	
Total :		25 Marks	Total : 75 Marks

Note: Peer-Team- Teaching shall conducted by forming a groups according the strength of the class with representation of both slow learners and fast learners. At least 10 % of the syllabus may be allocated with proportional allocation of teaching hours and be evaluated.

External examination question pattern :

Time: 3 Hours	Max. Marks: 75
Part – A (10*1=10)	
Answer all the questions Ten Questions, two questions from every unit: Multiple Choice questions.	
Part – B (5*7=35)	
Answer all the questions Five Questions, one question set from every unit: Either ...Or... type	
Part – C (3*10=30)	
Answer any three questions Five Questions, one question from every unit.	

II - Practical Subjects:

(Total Marks: 100 (Internal: 40 marks, External: 60 Marks))

- A candidate has to prepare Algorithm / Procedure for both the questions covering both the parts.
- The following list of parameters taken into account for the evaluation of practical examination.

Parameters			
Internal Marks		External Marks	
i.	Average of two tests	25 Marks	i.Aim, Procedure / Algorithm and Program 15 Marks
ii.	Record Work	10 Marks	ii.Coding and Compilation 10 Marks
iii.	Seminar/ Quiz / Viva	05 Marks	iii.Debugging 15 Marks
			iv.Results 10 Marks
			v.Viva-Voce 10 Marks
Total :		40 Marks	Total : 60 Marks

Note: The External Examiner can fix exercises also other than those found in the list (Syllabus) in consultation with the Internal Examiner without violating the scope of the prescribed syllabus.

III – Mini Project and Project Work:

(Total Marks: 100 (Internal: 40 marks, External: 60 Marks))

The following list of parameters taken into account for the evaluation of the Projectwork.

Parameters			
Internal Marks		External Marks	
Start-up Review:	5.0 Marks	i. Project Report:	20 Marks
Design Review:	7.5 Marks	ii. Project demo & Presentation :	30 Marks
Implementation and Validation Review:	7.5 Marks	iii. Viva-Voce :	10 Marks
Final Review :	10.0 Marks		
Overall Performance:	10.0 Marks		
Total :	40 Marks	Total :	60 Marks

The combined project shall be undertaken by the students as a team of two.
See Appendix–CA

I SEMESTER

FS 1: Mathematical Foundations of Computer Applications (4 Hours – 4 Credits)

Unit-I : Mathematical Logic: Statements and notations, Connectives, Well-formed formulas, Truth Tables, Tautology, equivalence implication, Normal forms, Theory of inference for the statement calculus; Rules of inference, Consistency of promises and indirect method of proof, Automatic Theorem Proving; Predicate calculus; Predicates, statement functions, variables and quantifiers, predicate formulas, free & bound variables, universe of discourse, inference theory of predicate calculus

Unit-II : Set theory & Relation: introduction, Relations and ordering, Properties of binary Relations, Equivalence, Compatibility Relations, Partial Ordering; Elementary Combinatory : Basis of counting, Enumeration of Combinations & Permutations, Enumeration of Combinations & Permutations with repetitions and constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, principles of Inclusion – Exclusion.

Unit-III : Graph Theory: Representation of Graph, Spanning Trees, BFS, DFS, Kruskals Algorithm, Binary trees, Planar Graphs Graph Theory and Applications, Basic Concepts, Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers

Unit-IV : Probability Theory: Random experiment- Conditional probability – independent event .Bayes theorem-Random variable, Two Dimensional Random Variable, Joint probability density, cumulative distribution, marginal probability, conditional probability

Unit-V : Tests of hypothesis: parameter and statistic, sampling distribution, Estimation and testing of hypothesis, Errors in testing of hypothesis, one tailed and two tailed test, procedure for testing hypothesis,

Reference Books:

1. Discrete Mathematical Structures with Applications to CS; Trembley, R.Manohar, TMH.
2. Discrete Mathematical for computer Scientists & Mathematicians, Molt, Kandel, Baker, PHI.
3. T.Veerarajan- Probability, Statistics and Random process (Third edition), TMH.
4. Sundarapandian- Probability, Statistics and Queueing theory, PHI.
5. PurnaChandriaBiswal – Probability and Statistics, PHI.
6. Elements of Discrete Mathematics, C.I.Liu, D P Mohanpatra, TMH.
7. Discrete Mathematical Structures, Kolman, Busby, Ross, 6th ed. PHI, 2009.

**CS 1: Digital Fundamentals and Computer Architecture
(4 Hours – 4 Credits)**

Unit-I : Number Systems - Binary Arithmetic - Boolean algebra - Map Simplifications - Gates - Combinational Circuits - Sequential Circuits.

Unit-II : Memory: Internal - External - Memory Organization - Associative - Cache – Virtual memory.

Unit-III : CPU: Arithmetic And Logic Unit - Instruction Sets - RISC - CISC - Instruction pipeline -Addressing modes and formats - Register organization - Control Unit Operation - Processor organization.

Unit-IV : External Devices: I/O modules - Programmed I/O - Interrupt Driven I/O - Direct Memory Access - I/O Channels - Asynchronous Data Transfer.

Unit-V : Processors: Parallel – Multi-core – Mobile – Embedded - Cloud computing.

Reference Books:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design", 5th Edition, Pearson Education, 2013.
2. William Stallings, "Computer Organization and Architecture", 9th Edition, PHI,2012
3. Hennessy J. and Patterson D., "Computer Architecture: A Quantitative Approach", 5th Edition, Morgan Kaufmann, 2011.
4. Mile Murdocca, Vincent Heuring, “ Computer Architecture and Organization”, John Wiley & Sons, 2007.
5. Sivarama P Dandamudi “Fundamentals of Computer Organization and Design”,

- Wiley DreamTech Publishers, 2003
6. G.V.Anjaneyulu, “Computer Organization”, Himalaya Publishing House.

CS 2: Problem Solving and Programming in C **(5 Hours – 4 Credits)**

Unit-I : Introduction to Computer Problem Solving: Introduction–The Problem Solving aspect – Top down design – Implementation of algorithm – Program Verification – The efficiency of algorithms – The analysis of algorithms – Fundamental Algorithms.

Unit-II : Programming and algorithms : Programs and Programming–building blocks for simple programs -pseudo code representation – flow charts - Programming Languages - compiler –Interpreter, Loader and Linker - Program execution – Classification of Programming Language - Structured Programming Concept.

Unit-III : Basics of „C“ , Input / Output & Control Statements: Introduction- Identifier–Keywords - Variables – Constants – I/O Statements - Operators - Initialization –Expressions – Expression Evaluation – Lvalues and Rvalues – Type Conversion in C –Formatted input and output functions - Conditional Execution - and Selection – Iteration and Repetitive Execution- go to Statement – Nested Loops- Continue and break statements

Unit-IV : Arrays, Strings, Functions and Pointers: Array–One dimensional Character Arrays- Multidimensional Arrays- Arrays of Strings – storage classes – recursion - pointers – pointer operators - uses of pointers- arrays and pointers - pointers to functions - Dynamic memory allocation.

Unit-V : User-Defined Data types & Files: Structures–initialization - nested structures–structures and arrays – structures and pointers - union– type def and enumeration types - bit fields - File Management in C – Files and Streams – File handling functions – Sequential access file- Random access file – Command line arguments.

Reference Books:

1. How to Solve it by Computer, R.G. Dromey, Pearson education , Fifth Edition, 2007.
2. Reema Thareja, “Programming in C”, Oxford University Press, 2011
3. PradipDey, Manas Ghosh, —Computer Fundamentals and Programming in C, Second Edition, Oxford University Press, 2013.
4. Byron S Gottfried, —Programming with C++ , Schaums Outlines, Second Edition, Tata Mc Graw-Hill, 2006.
5. Brian W. Kernighan and Dennis M. Ritchie, “The C programming Language”,2006, Prentice-Hall.
6. Cormen, Leiserson, Rivest, Stein, “ Introduction to Algorithms”, McGraw Hill, Publishers, 2002.
7. Deitel and Deitel, “C How to Program”, Pearson Education. 2013,7th Edition.
8. Kamthane, A.N., “Programming with ANSI and Turbo C”, Pearson Education, Delhi, 2006.

9. Mastering C- by K R Venugopal ,Sudeep R Prasad McGraw Hill Education (India) Private Limited; Second edition 2015.
10. YashavantKanetkar, “Understanding Pointers In C”, 4th Revised & Updated Edition, 2011, BPB Publications.

CS 3: LAB: Programming in C (5 Hours – 3 Credits)

Section A

Develop programs for simple problems

1. Write a C Program (WCP) to find the sum of digits
2. WCP to check whether a given number is Armstrong or not
3. WCP to check whether a given number is Prime or not
4. WCP to generate the Fibonacci series
5. WCP to display the given number is Adam number or not
6. WCP to print reverse of the given number and string
7. WCP to find minimum and maximum of „n“ numbers using array
8. WCP to arrange the given number in ascending order
9. WCP to add, subtract and multiply two matrices
10. WCP to calculate NCR and NPR

Section B

Develop programs for complex problems applying the concepts of Arrays and pointers.

1. WCP to find the grade of a student using else if ladder
2. WCP to implement the various string handling function
3. WCP to create an integer file and displaying the even numbers only
4. WCP to calculate quadratic equation using switch-case
5. WCP to implement the various string handling function

Section C

Develop programs for complex problems applying the concepts of structures and files.

1. WCP to generate student mark list using array of structures
2. WCP to create and process the student mark list using file
3. WCP to create and process pay bill using file
4. WCP to create and process inventory control using file
5. WCP to create and process electricity bill using file

II - SEMESTER

FS 2: Optimization Techniques (4 Hours – 4 Credits)

Unit-I : Introduction to O.R – Linear Programming Problem formulation – Graphical Method – Simplex Method – Big M-method – Duality – Dual Simplex Method.

Unit- II : Transportation problems – Vogel’s approximation method – MODI method – Travelling salesman problem.

Unit-III : Game theory – Two persons zero sum game – game with and without saddle point – solution of 2 x 2 game – dominance – Graphical Method. Network scheduling – Critical path – CPM – PERT. PERT algorithm

Unit-IV : Inventory problems – Deterministic Model – EOQ Model with uniform demand – Production Inventory Model – Inventory model with planned shortages and inventory model with quantity discounts

Unit-V : Queuing Theory – Poisson and Exponential distribution – Birth-Death process – Queues with combined arrivals and departures

Reference Books:

1. Operations Research – KantiSwarup, P.K. Gupta and Manmohan – Sultan Chand and Sons 2009.
2. Operation Research, S. D. Sharma, KedarNath Ram Nath& Co, 2004.
3. Linear Programming, Dr.S.Arumugam, A.Thangapandi Isaac, New Gamma Publication, 2010.
4. Operations Research,T.Veerarajan, University Press, 2017.
5. Optimization Techniques in Operation Research, C.B .Gupta,I. K. International Pvt Ltd, 2008
6. Optimization Techniques, Chander Mohan, Kusum Deep, New Age Science, 2009.

**ES 01: Machine Learning
(4 Hours – 4 Credits)**

Unit-I : Introduction : Machine Learning - Machine Learning Foundations–Overview– applications - Types of machine learning - basic concepts in machine learning Examples of Machine Learning -Applications – Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison

Unit-II : Supervised Learning: Linear Models for Classification - Discriminant Functions - Probabilistic Generative Models -Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees – Classification Trees- Regression Trees - Pruning. Neural Networks -Feed-forward Network Functions - Error Backpropagation- Regularization - Mixture Density and Bayesian Neural Networks - Kernel Methods -Dual Representations - Radial Basis Function Networks. Ensemble methods- Bagging- Boosting.

Unit-III : Unsupervised Learning: Clustering- K-means - EM - Mixtures of Gaussians – The EM Algorithm in General -Model selection for latent variable models - high-dimensional spaces -- The Curse of Dimensionality –Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis

Unit-IV : Probabilistic Graphical Models: Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties – From Distributions to Graphs -Examples -Markov Random Fields - Inference in Graphical Models – Learning–Naive Bayes classifiers-Markov Models – Hidden Markov Models – Inference – Learning-Generalization – Undirected

graphical models- Markov random fields- Conditional independence properties - Parameterization of MRFs - Examples - Learning - Conditional random fields (CRFs) - Structural SVMs

Unit-V : Advanced Learning: Sampling–Basic sampling methods–Monte Carlo.Reinforcement Learning- K-Armed Bandit-Elements - Model-Based Learning- Value Iteration- Policy Iteration. Temporal Difference Learning-Exploration Strategies-Deterministic and Non-deterministic Rewards and Actions- Eligibility Traces-Generalization- Partially Observable States- The Setting- Example. Semi - Supervised Learning. Computational Learning Theory - Mistake bound analysis, sample complexity analysis, VC dimension. Occam learning, accuracy and confidence boosting

Reference Books:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2006
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012
3. Ethem Alpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2005
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
5. Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning” (2nd ed)., Springer, 2008
6. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009

**CS 4: Object Oriented Programming and Design
(5 Hours – 4 Credits)**

Unit-I : Introduction to OOP – Overview of C++ - Classes – Structures – Union – Friend Functions – Friend Classes – Inline functions – Constructors – Destructors – Passing objects to functions – Function returning objects-Arrays of Objects, Object as Function Arguments

Unit-II : Arrays – Pointers – this pointer – References – Dynamic memory Allocation – functions Overloading – Default arguments – Overloading Constructors – Pointers to Functions

Unit-III : Inheritance – Types - Derived Class Constructors- Issues in Inheritance – Virtual base Class – Polymorphism

Unit –IV : Class templates and generic classes – Function templates and generic functions – Overloading function templates – power of templates – Exception Handling – Derived class Exception – over handling generic functions – Exception handling Functions

Unit-V : Streams – Formatted I/O with IOS class functions and manipulators –File I/O – Name spaces –Array based I/O – Error handling during file operations - Formatted I/O.

Reference Books:

1. Stephen Prata, ”C++ Primer Plus”, 6th Edition ,Addison-Wesley Professional, 2011
2. Bjarne Stroustrup, “Programming: Principles and Practice Using C++,1st Edition, Addison-Wesley Professional, 2008

3. Andrew Koenig and Barbara E. Moo, “Accelerated C++: Practical Programming by Example”, 1st Edition, Addison-Wesley Professional, 2000
4. Bruce Eckel ,”Thinking in C++: Introduction to Standard C++: Volume One” 2nd Edition ,PrenticeHall, 2000
5. Andrei Alexandrescu , “Modern C++ Design: Generic Programming and Design Patterns Applied” , 1st Edition, Addison-Wesley Professional, 2001

CS 5: LAB: Object Oriented Programming using C++ (5 Hours – 3 Credits)

Section A

1. Write a C++ Program to illustrate Enumeration and Function Overloading\
2. Write a C++ Program to illustrate Scope and Storage class
3. Write a C++ Program to illustrate the use of Constructors and Destructors and Constructor Overloading
4. Write a C++ program to illustrate the Call-by-Value and Call-by-Reference
5. Write a C++ Program to illustrate Static member and methods
6. Write a C++ Program to illustrate Bit fields
7. Write a C++ Program to overload as binary operator, friend and member function
8. Write a C++ Program to overload unary operator in Postfix and Prefix form as member and friend function
9. Write a C++ Program to illustrate Iterators and Containers
10. Write a C++ Program to illustrate function templates
11. Write a C++ Program to illustrate template class
12. Write a C++ Program to illustrate Virtual functions
13. Write a C++ Program to illustrate Exception Handling
14. Write a C++ Program to illustrate File Handling – Read, Write, Update

Section B

1. Write a C++ program with suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc.
2. Write a C++ program to create stack and queue classes with necessary exception handling
3. Write a C++ Manage bank account using inheritance concept using C++
4. Write a C++ program to Implement Matrix class with dynamic memory allocation and necessary methods. Give proper constructor, destructor, copy constructor, and overloading of assignment operator.

III SEMESTER

CS 6: Data Communication and Computer Networks (4 Hours – 4 Credits)

Unit-I : Introduction to Data Communications : Components of data communication, Data representation, Transmission Impairments, Switching, Modulation, Multiplexing, Review of Network Hardware : LAN,MAN,WAN, Wireless networks, Internet works, Review of Network Software : Layer, Protocols, Interfaces and services. Reference Models: OSI, TCP/IP and their comparison.

Unit-II : Physical Layer: Transmission Media: Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (Radio, Microwave, Infrared). Introduction to ATM, ISDN, Cellular Radio and Communication Satellites. Data Link Layer – Services provided by DLL; FRAMING ERROR CONTROL, FLOW CONTROL, MEDIUM ACCESS, Medium Access Sub layer; Channel Allocation, MAC protocols – ALOHA, CSMA protocols, Wireless LAN protocols, IEEE 802.3, 802.4, 802.5 standards and their comparison.

Unit-III : Network Layer Design Issues, Routing Algorithms (Shortest Path, Flooding, Distance Vector Hierarchical, Broadcast, Multicast).congestion Control Algorithms (Leaky bucket, Token bucket, Load shedding), Internetworking, IP Protocol, ARP,RARP, Network Trouble Shooting Using Ping, Tracer route, IP config, Netstat,nslookup.

Unit-IV : Transport Layer Addressing, Establishing And Releasing Connection, Flow Control, Buffering, Internet Transport Control(TCP and UDP), Application Layer – DNS – TELNET-FTP-SMTP –POP-SNMP-HTTP-IP Over ATM-Mobile IP-Multimedia : audio and video compression - Name Service, Email- Architecture and services, TELNET, File Transfer Protocol(FTP), Simple Network Management Protocol (SNMP) Simple Mail Transfer Protocol(SMTP), Hyper Text Transfer Protocol(HTTTP),World Wide Web(WWW).

Unit-V : Cryptography: Symmetric key cryptography- asymmetric key cryptography – security services: Message confidentiality-message integrity-message authentication-entity authentication-digital signature key management-security in internet: IPSec-SSL/TLS-PGP-Firewalls. Introduction to MPLS- Tunneling-QoS.

References Books:

1. Behroz A. forouzan, "Data Communication and Networking", The McGraw Hill Education Private Limited, New Delhi.
2. Behroz A. forouzan, "TCP/IP Protocol suite", The McGraw Hill edition, New Delhi.
3. "Data communication and computer networks", ISRD group, TMH publications.
4. Larry L. Peterson Bruce S. Davie, "Computer Networks - a system approach", Morgan Kaufmann publishers.
5. Andrews S Tanenbaum, "Computer Networks", Prentice Hall.

**ES2: Internet of Things
(4 Hours – 4 Credits)**

Unit- I : Introduction to IoT: Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

Unit-II : IoT Architecture: M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model Domain model - information model - functional model - communication model - IoT reference architecture.

Unit-III : IoT Protocols : Protocol Standardization for IoT–Efforts–M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BAC Net Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security.

Unit-IV : Building Iot with Raspberry PI& Arduino: Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices Endpoints - IoT Device - Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

Unit-V: Case Studies and Real-World Applications: Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT

Reference Books:

1. Arshdeep Bahga, Vijay Madiseti, “Internet of Things – A hands-on approach”, Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
3. Jan Ho" ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Aves and. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012

**CS 7: Data Warehousing and Mining
(5 Hours – 4 Credits)**

Unit-I : Introduction - Why Data Mining? - What is Data Mining? - What Kinds of Data Can Be Mined? - What Kinds of Patterns Can Be Mined? - Which Technologies Are Used?Which Kinds of Applications Are Targeted? Major Issues in Data Mining. Getting to Know Your Data: Data Objects and Attribute Types - Basic Statistical Descriptions of Data - Data Visualization –Measuring Data Similarity and Dissimilarity.

Unit –II : Data Preprocessing: Data Preprocessing An Overview - Data Cleaning - Data Integration - Data Reduction - Data Transformation and Data Discretization. Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts - Data Warehouse Modeling: Data Cube and OLAP - Data Warehouse Design and Usage - Data Warehouse Implementation.

Unit-III : Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods - Frequent Item set Mining Methods - Which Pattern Are Interesting? - Pattern Evaluation Methods. Advanced Pattern Mining: Pattern Mining: A Road Map - Pattern Mining in Multilevel, multidimensional Space - Constraint - Based Frequent Pattern Mining High - Dimensional Data and Colossal Patterns - Mining Compressed or Approximate Patterns - Pattern Exploration and Application.

Unit-IV : Classification: Basic Concepts - Basic Concepts - Decision Tree Induction - Bayes Classification Methods - Rule-Based Classification- Model Evaluation and Selection - Techniques to Improve Classification Accuracy.

Unit-V : Cluster Analysis Basic Concepts and Methods: Cluster Analysis - Partitioning Methods - Hierarchical Methods - Density Based Methods - Grid Based Methods - Evaluation of Clustering.

Reference Books:

1. Data Mining Concepts and Techniques - Third Edition, Jiawei Han, Micheline Kamber, Jian Pei
2. Insight into Data mining Theory and Practice K.P. Soman, ShyamDiwakar and V. Ajay, Easter Economy Edition, Prentice Hall of India, 2006.
3. Introduction to Data Mining with Case Studies,G. K. Gupta, Easter Economy Edition, Prentice Hall of India, 2006.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Pearson Education, 2007.
5. Modern Data Warehousing, Mining, and Visualization, MARAKAS, GEORGE M, Pearson Education, 2011.

CS 8: LAB: Data Mining
(5 Hours – 3 Credits)

Tool: „R“ Software

Simple Programs

1. Find Sum, Mean and Product of Vector in R
2. R Program to sample from a Population
3. R Program to Sort a Vector.
4. To combine the matrix using rbind and cbind methods.
5. Use seq() to create sequence.
6. Write a program to convert the table data into data frame.
7. Calculate student mark list and output it in data frame.

Decisions and loops

7. R Program to Check Prime Number
8. R Program to Check for Leap Year.
9. R Program to Check if a Number is Odd or Even in R
10. R Program to Find the Sum of Natural Numbers

Functions

11. Convert Decimal into Binary using Recursion in R
12. R program to Find the Factorial of a Number Using Recursion
13. R Program to Make a Simple Calculator

Data Set and Graphs

14. Write a R Program to import CSV data into R.
15. Write a R Program to move the result data from R to CSV.
16. Draw the Line Graph for Student Data.
17. Draw the Pie-Chart for Employee Data.

18. Create a Table from the existing data set in R and draw the chart.
19. Apply K-Means Algorithm for IRIS data set and output it in graph
20. Get some input from mtcars data set and perform analysis.

IV SEMESTER
CS 9: Software Engineering
(4 Hours – 4 Credits)

Unit-I : INTRODUCTION: Software Engineering Paradigms–Waterfall Life Cycle Model - Spiral

Model – Prototype Model – Agile Process Model – Unified Process Model - Planning – Software Project Scheduling – SRS - Case Study: Project Plan and SRS.

Unit-II : SOFTWARE DESIGN: Designing Concepts - Abstraction–Modularity–Software Architecture – Cohesion – Coupling – Dataflow Oriented Design - Jackson System Development - Real time and Distributed System Design – Designing for Reuse — Case Study : Design for any Application Oriented Project.

Unit-III : SOFTWARE TESTING AND MAINTENANCE : Software Testing Fundamentals – Software Testing Strategies – Black Box Testing – White Box Testing – System Testing – Object Orientation Testing – State Based Testing – Testing Tools – Test Case Management – Types of Maintenance – Case Study: Testing Techniques

Unit-IV : SOFTWARE METRICS: Scope–Classification of metrics–Measuring Process and Product attributes – Direct and Indirect measures – Cost Estimation - Reliability – Software Quality Assurance – Standards – Case Study for COCOMO model.

Unit-V : SCM & WEB ENGINEERING: Need for SCM–Version Control–SCM process – Software Configuration Items – Taxonomy – Re Engineering – Reverse Engineering - Web Engineering - CASE Repository – Features

Reference Book :

1. Ali Behforrooz, Frederick J. Hudson, “Software Engineering Fundamentals”, Oxford Indian Reprint, 2012.

ES 3: Big Data Analytics
(4 Hours – 4 Credits)

Unit-I : Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis Vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error

Unit-II : Mining Data Streams: Introduction To Streams Concepts–Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications — Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

Unit-III : Hadoop Environment: History of Hadoop- The Hadoop Distributed File System– Components of Hadoop-Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS- Hadoop file systems-Java interfaces to HDFS- Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features - Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation – Hadoop Configuration-Security in Hadoop

Unit-IV: Data Analysis Systems and Visualization: Link Analysis–PageRank - Efficient Computation of PageRank- Topic-Sensitive PageRank– Link Spam-Recommendation Systems- A Model for Recommendation Systems- Content-Based Recommendations - Collaborative Filtering- Dimensionality Reduction- Visualizations - Visual data analysis techniques-interaction techniques- Systems and applications.

Unit-V : Frameworks and Applications: IBM for Big Data–Framework - Hive– Shading– NoSQL Databases –Mango DB- Casandra - Hbase – Impala – Analyzing big data with twitter – Big data for Ecommerce – Big data for blogs.

Reference Books:

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, Mc Graw Hill Publishing, 2012
3. Da Ruan, Guoqing Chen, Etienne E. Kerre, Geert Wets, Intelligent Data Mining, Springer, 2007
4. Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012
5. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007
6. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.
7. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
8. Michael Minelli , Michele Chambers , Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications, 2013.
9. Paul Zikopoulos ,Dirk de Roos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata Mc Graw Hill Publications, 2012.
10. Pete Warden, “Big Data Glossary”, O’ Reilly, 2011
11. Tom White “ Hadoop: The Definitive Guide” Fourth Edition, O’reilly Media, 2015
12. Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011.

CS 10: Dot Net **(5 Hours – 4 Credits)**

Unit-I : Building-blocks of C#: C# the Trailblazer–Productivity of C# - Features, and Advantages – C# Vs. Java –Overview of C# - Gaining momentum with C# programs in VS.NET – Keywords – Data Types, Literals, and Variables – Value Types, Integers, Floating-Point Types, The Decimal Type, Characters, The Bool Type - Literals – Character Escape Sequences -Working with Variables – Scope, Type Conversion and Casting-Operators – Program Control Structures – Classes and Objects – Arrays and Strings.

Unit-II : Advanced Programming concepts in C#: Inheritance–Constructors and Inheritance, Name Hiding, Virtual Methods Overriding, Boxing and Unboxing – Indexers and Properties, Interfaces Vs. Abstract Classes –Structures – Enumerations – Exception Handling – Try and Catch, Multiple Catch Clauses, Nesting Try Blocks, Using Finally, Using Checked and Unchecked – Delegates– Multicasting, Covariance and Contra variance – Anonymous Functions Vs. Methods –Lamda Expressions – Events – Reflection, and Attribute – Unsafe Code, Pointers -Introduction to Generics, and LINQ – Multithreaded Programming using TPL and PLINQ

Unit-III : Features-rich Web Application Development using ASP.NET: Introduction to ASP.NET - Advantages of ASP.NET - ASP.NET Architecture – ASP Vs.ASP.NET - ASP.NET Page’s Structure - Sample Program in ASP.NET - Page Events -HTML Server Controls - Basic Web Server Controls - Data List Web Server Controls -Validation Controls - Web User Controls in ASP.NET

Unit-IV : Intrinsic Objects, and Security Mechanism in ASP.NET: Objects and Advanced Concepts in ASP.NET: Request Object - Response Object - Code-Behind Feature of ASP.NET - Caching in ASP.NET - Output Caching – Fragment Caching - Data Caching - Session / State Management – Events and Abandon Method –Authentication in ASP.NET - Error Handling and Debugging - Tracing an Application –Accessing Data with ADO.NET – Implementing Crystal Reports in ASP.NET

Unit-V : Introduction to Windows Phone Apps Development: Mobile Application Development – Featured Phone Vs. Smart Phone – Smart Phone Oss– Introducing Windows Phone 7 and the Windows Phone Platform - Building Windows Phone 7 Applications - Using Cloud Services as Data Stores - Catching and Debugging Errors - Packaging, Publishing, and Managing Applications

Reference Books:

1. Herbert Schildt, “C# 4.0”, Edition 2010, Tata McGraw-Hill.
2. Kogent Learning Solutions, “ASP.NET 4.0 Black Book”, Reprint 2012, Dreamtech Press.
3. Matt J.Crouch, “ASP.NET and VB.NET Web Programming”, Edition 2012, Pearson Education.
4. Henry Lee, Eugene Chuvyrov, “Beginning Windows Phone App Development”, , Apress, 2012 Edition.
5. John Sharp, “Microsoft Visual C# 2010”, Reprint 2011, Dreamtech Press.

6. Ben Watson, “C# 4.0 How-To”, Edition 2010, Pearson Education.
7. Stephen Walther, Kevin Hoffman, Nate Dudek, “ASP.NET 4 Unleashed”, Second Impression 2013, Pearson Education.

CS 11: LAB: Dot Net (5 Hours – 3 Credits)

1. Develop a control application to demonstrate the control structures in C#
2. Demonstrate Indexers and Properties
3. Demonstrate Interfaces, Structures, and Enumerations
4. Demonstrate Delegates, and Events
5. Demonstrate the working mechanism of PLINQ
6. Develop a web application to demonstrate various web server controls
7. Demonstrate the validation controls in ASP.NET
8. Demonstrate caching in ASP.NET
9. Demonstrate the intrinsic objects in ASP.NET
10. Develop a web application for students’ information management with crystal reports
11. Demonstrate LINQ to an SQL application
12. Develop a basic Windows Phone Application.

EES 1: Mini Project and Report writing (2 Hours – 1 Credit)

Students will be able to

1. Identify the problem from the core subjects related to the project work
2. Implement the case studies using the concepts and techniques in the curriculum
3. Use Latex to compile Mini Project work report

V SEMESTER

CS 12: Information Security (4 Hours – 4 Credits)

Unit-I : Introduction: What is security? What is management? Principles of information security management. **Planning for security:** role of planning, precursors to planning, strategic planning.

Planning for contingencies : Fundamentals and components of contingency planning.

Unit-II : Information security policy: why policy? Enterprise information security policy, issue specific security policy, system specific security policy.

Developing the security program : organizing for security, placing information security within an organization, components of the security program, information security roles and titles.

Unit-III : Security management models: blue print, framework and security models, access control model, security architecture models, security management models- **Security management practices:** benchmarking, performance management.

Unit-IV : Risk management : identifying and assessing risk-risk management, identification,

assessment. **Controlling risk** : risk control strategies, managing risk.

Unit-V : Production mechanism: access control, firewalls, intrusion detection and prevention systems, remote access protection, wireless networking protection, scanning and analysis tools, cryptography.

Reference Books:

1. Management of Information Security, 4th Edition, 2014, Michael E. Whitman and Herbert J. Mattord.
2. “Principles of Information Security”, Michael E Whitman and Herbert J Mattord, Vikas Publishing House, New Delhi, 2003.
3. Information Security Management Principles, Andy Taylor, 2nd edition, 2013.
4. Fundamentals of Information Systems Security, by David Kim, Jones & Bartlett Learning, 3rd Edition, 2018.

**CS13: Relational Database Management Systems
(5 Hours – 4 Credits)**

Unit-I : File System versus DBMS – Advantages – Database Languages – ER-Model: Entities – Relationships – Additional Features of ER Model – Conceptual Design with ER Model.

Unit-II : Relational Model – Keys - Constraints – Querying – Views - Relational Algebra – Relational Calculus – SQL – QBE.

Unit-III : File Organization – Organization of records in files – Indexing – Ordered Indices - B + Tree Index files – Hashing – Static – Dynamic – Query Optimization – Transformation of Relational Expressions – Choice of evaluation plans.

Unit-IV : Database Design – Pitfalls in Relational Database Design – Functional Dependencies – Decomposition – Normalization – I to V Normal Forms

Unit-V : DB Tuning – Security – Transaction Management – Transactions – Transaction state – Concurrent executions – Serializability – Concurrency Control – Protocols – Crash Recovery

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke, “Data Base Management Systems”, 3rd Edition, Mc Graw-Hill, 2014.
2. Raghu Ramakrishnan and Johannes Gehrke, “Data Base Management Systems”, 3rd Edition, McGraw-Hill, 2007.
3. Silberschatz, Korth and Sudarshan, “Data Base System Concepts”, Mc Graw-Hill, 6th Edition, 2010.
4. C. J. Date, “An Introduction to Database Systems”, 8th Edition, Addison-Wesley, 2003.
5. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, 5th Edition, Pearson Education/Addison Wesley, 2007.
6. SQL, PL/SQL The programming Language of Oracle (3rd Edition) – Ivan Bayross.

7. Peter Rob, Carlos coronel , “Database System Concepts” , Ceange Learning 2008

CS 14: Mobile Computing (5 Hours – 4 Credits)

Unit-I : INTRODUCTION: Mobile Computing–Mobile Computing Vs wirelessNetworking – Mobile Computing Applications –Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

Unit-II : MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER: Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.

Unit-III : MOBILE TELECOMMUNICATION SYSTEM: Global System for MobileCommunication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

Unit-IV : MOBILE AD-HOC NETWORKS: Ad-Hoc Basic Concepts–Characteristics– Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET– Security.

Unit-V : MOBILE PLATFORMS AND APPLICATIONS: Mobile Device OperatingSystems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – M Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

Reference Books:

1. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt. Ltd, New Delhi, 2012.
2. Jochen H. Schller, “Mobile Communications”, Second Edition, Pearson Education, New Delhi, 2007.
3. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt. Ltd., 2005.
4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”,Springer, 2003.
5. William.C.Y.Lee,“Mobile Cellular Telecommunications-Analog and Digital Systems”, Second Edition, Tata Mc Graw Hill Edition,2006.
6. Mobile Computing, V. Jeyasri Arokiamary, Technical Publications, 2009.

CS 15: LAB: Mobile Computing (5 Hours – 3 Credits)

1. Develop an application that uses Layout Managers.
2. Develop an application that uses event listeners.
3. Develop an application that uses Adapters ,Toast.

4. Develop an application that makes use of database.
5. Develop an application that makes use of RSS Feed.
6. Implement an application that implements Multi threading.
7. Develop a native application that uses GPS location information.
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message.
10. Develop a game application.

VI SEMESTER

EES 2: Project Work and Viva-Voce

(14 Credits)

(Industry / Institutional based)

Six Months internal/external project work with submission of project work and viva-voce examination

Students will be able to

1. Implement the solution for the chosen problem using the concepts and techniques in the curriculum.
2. Record the research to the development process of a particular problem.
