Syllabus for M.C.A. (Under Science Faculty) in affiliated colleges to University of Pune

(To be implemented from Academic year 2013-2014)

Credit Based System

- **Course Structure –**

  Duration: The entire Programme is a Three year and Six semester full time Programme.
  No. of Courses: For first five semesters there will be Six courses. The last semester will be Industrial training/Institutional project and two theory courses.

- **Salient Features –**

  1. Each Theory course will be of 4 credits and each Lab. Course (Practical) of 5 credits.
  2. Each semester is of 6 courses and 25 credits (This is not applicable for Industrial training in VI semester of M.C.A.).
  3. Each regular student will have to appear for all the 25 credits of the respective semester.
  4. Student who wishes to take admission to the second year M.C.A should have obtained at least 25 credits out of 50 credits of the First year M.C.A.
  5. A student will have to complete at least 75% credits (other than for IT – SemVI) from M.C.A. (Under Science Faculty) syllabus. The remaining 25% credits (other than for IT–SemVI) can be chosen from the courses offered by the other Departments/subjects (other than Computer Science courses) with credits system structure.

- **Evaluation Rules –**

  Pattern of Examination

  Evaluation of Students:

  1) The In-semester and End-Semester examinations will be of 50 marks each.
  2) Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% passing in both assessments separately.
  3) A student cannot register for third semester/fourth semester if s/he fails to complete the minimum of 50% credits of the total credits of two semesters of the first year.
  4) Internal marks will not change. Student cannot repeat internal assessment. If student misses internal assessment examination, s/he will have second chance with the permission of the concerned teacher. But it will not be right of the student. It will be the discretion of the concerned teacher and internal departmental assessment committee.
  5) There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

6) Internal assessment (IA) answer scripts may be shown to the concerned student but not end semester answer script.

Internal Assessment (Continuous Assessment): Internal assessment for each course would be continuous and dates for each tutorials/practical tests will be pre-notified in the time table for teaching or placed separately as a part of time table. Department / College Internal Assessment Committee will coordinate this activity

Theory Courses: Conducting written tests should not be encouraged. More focus should be on non-written tests. Students should be encouraged to conduct various academic activities. A teacher must select a variety of the procedures for internal assessment suggested as follows.

a) Mid-term test
b) On-line test
c) Open book test (concerned teacher will decide the allowed books)
d) Tutorial
e) Surprise test
f) Oral
g) Theory Assignments
h) Review of Research paper
i) Seminar presentation
j) Journal/Lecture/Library notes
k) Group Discussion
l) Programming Assignments

Student has to preserve the documentation of the internal assessment except midterm test answer script. It is the responsibility of the student to preserve the documents.

Project Courses : The Project can be platform, Language and technology independent. Project will be evaluated by project guide. Assessment will be done weekly in the respective batch. Evaluation will be on the basis of weekly progress of project work, progress report, oral, results and documentation.

University Examination (UE): End-Semester examination for 50 marks per course would be held as per the scheduled given by University of Pune.

1. If a student fails in a course of any semester then the student can appear only for the End of Semester Examination of the following semester. However he/she can improve the Internal Assessment (continuous assessment) performance in any of the forthcoming semesters in which the course is subsequently conducted and in this case, the student will have to appear for End of Semester Examination also for the said course.
2. The assessment of 17 credits towards VI th semester (Full Time Industrial Training / Institutional project) will be carried out as follows:
   i. A student will inform the department about the joining date of the above mentioned training.

ii. The student will have to make minimum two presentations, one in the third month and the other at the end of the training programme. These presentations will be considered towards CA.
iii. The student will have to submit a Dissertation/Report to the department which will be assessed towards course credits.

Award of Class

Grades will be awarded from grade point average (GPA) of the credits.

GPA Rules:

1. The formula for GPA will be based on Weighted Average. The final GPA will not be printed unless a student passes courses equivalent to minimum 150 credit hours (Science). Total credits hours means the sum of credit hours of the courses which a student has passed.
2. A seven point grade system [guided by the Government of Maharashtra Resolution No. NGO – 1298 / [4619] / UNI 4 dt. December 11, 1999 and University regulations] will be followed. The corresponding grade table is attached herewith.
3. If the GPA is higher than the indicated upper limit in the third decimal digit then the student be awarded higher final grade (e.g. a student getting GPA of 4.492 may be awarded 'A')
4. For Semester I, II, III examinations, only the grade points will be awarded for each subject. Final GPA along with final grade will be awarded only at the end of IV semester. There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course.
5. After the declaration of result, for the improvement of Grade, the student can reappear for the examination of minimum 30 credits worth theory courses.

Grade and Grade Point Average		
Marks	Obtained Grade	Grade Points
100 – 75	'O' Outstanding	06
74 – 65	'A' Very Good	05
64 – 55	'B' Good	04
54 – 50	'C' Average	03
49 – 45	'D' Satisfactory	02
44 – 40	'E' Pass	01
39 and less	'F' Fail	00

Final Grade Points	
Grade Points	Final Grade
5.00 – 6.00	O
4.50 – 4.99	A
3.50 – 4.49	B
2.50 – 3.49	C
1.50 – 2.49	D
0.50 – 1.49	E
0.00 – 0.49	F

Common Formula for Grade Point Average (GPA):

$$GPA = \frac{\text{Total of Grade Points earned} \times \text{Credit hours for each course}}{\text{Total Credit hours}}$$

B Grade is equivalent to at least 55% of the marks

External Students: There shall be no external students.

Setting of Question Paper / Pattern of Question Paper

For core (compulsory) theory courses end semester question papers set by the University of Pune and centralized assessment for theory papers done as per the University guidlines.

Verification / Revaluation

- There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. There shall be revaluation of end semester examination, but not of internal assessment.

Completion of Degree Programme

1) As soon as a student obtains 150 credits (completion of Industrial training (IT) and 75% of the credits from the syllabus excluding IT is essential), the student will be deemed to have completed the requirements of the M.C.A.(Science) degree programme.
2) If a student has failed in a course then the said course will not be taken into account for calculating GPA and overall grade. In fact, all the courses in which a student has passed will be taken into account for calculating the GPA and overall grade.
3) The policies and procedures determined by University will be followed for the conduct of examinations and declaration of the result of a candidate

Course Structure MCA (Science) for Affiliated Colleges

Year/ Semester	Subject	Paper	Title of Paper	Hours / Week	Credit	% of Assessment		
						IA	UE	Total
I Year Sem-I	Core	CA-101	Programming with C	4	4	50	50	100
	Core	CA-102	DBMS	4	4	50	50	100
	Core	CA-103	Mathematical Foundation	4	4	50	50	100
	Core	CA-104	Concrete Mathematics Graph Theory	4	4	50	50	100
	Core	CA-105	Computer Organisation	4	4	50	50	100
	Core	CA-106	Lab on CA-101 & CA-102	4	5	50	50	100

Minimum Credit : 25, Core Subject is compulsory IA- Internal Assessment, UE –University Examination.

Year/ Semester	Subject	Paper	Title of Paper	Hours/ Week	Credit	% of Assessment		
						IA	UE	Total
I Year Sem-II	Core	CA-201	Data Structures	4	4	50	50	100
	Core	CA-202	TCS	4	4	50	50	100
	Core	CA-203	OOP- C++	4	4	50	50	100
	Core	CA-204	Computer Networks	4	4	50	50	100
	Core	CA-205	ADBMS	4	4	50	50	100
	Core	CA-206	Lab. on CA-201,CA-203 & CA-205	4	5	50	50	100

Minimum Credit : 25 , Core Subject is compulsory. IA- Internal Assessment, UE –University Examination.

Year/ Semester	Subject	Paper	Title of Paper	Hours / Week	Credit	% of Assessment		
						IA	UE	Total
II Year Sem-III	Core	CA-301	DAA	4	4	50	50	100
	Core	CA-302	Operating System	4	4	50	50	100
	Core	CA-303	Software Engineering	4	4	50	50	100
	Core	CA-304	Java	4	4	50	50	100
	Core	CA-305	Lab. on 302 & 304	4	5	50	50	100
	Elective	CA-306	Project	4	4	50	50	100
	Elective	CA-307	Numerical Methods	4	4	50	50	100
	Elective	CA-308	Multimedia Systems	4	4	50	50	100
	Elective	CA-309	Dot Net	4	4	50	50	100

Minimum Credit : 25 , Maximum Credit 29 . Core Subject is compulsory, From elective courses student can select one course for Minimum credit and Two for Maximum Credit. IA- Internal Assessment, UE –University Examination.

Year/ Semester	Subject	Paper	Title of Paper	Hours / Week	Credit	% of Assessment		
						IA	UE	Total
II Year Sem-IV	Core	CA-401	Computer Graphics	4	4	50	50	100
	Core	CA-402	SDK	4	4	50	50	100
	Core	CA-403	Advance Java	4	4	50	50	100
	Core	CA-404	Object oriented Software Engineering	4	4	50	50	100
	Core	CA-405	Lab. on 401,402 &403	4	5	50	50	100
	Elective	CA-406	Project	4	4	50	50	100
	Elective	CA-407	Cyber Law	4	4	50	50	100
	Elective	CA-408	Soft Computing	4	4	50	50	100
	Elective	CA-409	Artificial Intelligence	4	4	50	50	100

Minimum Credit : 25 , Maximum Credit 33 . Core Subject is compulsory, From elective courses student can select one course for Minimum credit and Three for Maximum Credit. IA- Internal Assessment, UE –University Examination.

Year/ Semester	Subject	Paper	Title of Paper	Hours / Week	Credit	% of Assessment		
						IA	UE	Total
II IYear Sem-V	Core	CA-501	Internet Programming	4	4	50	50	100
	Core	CA-502	Principle of Programming Langauges	4	4	50	50	100
	Core	CA-503	Data Mining & Warehousing	4	4	50	50	100
	Core	CA-504	Software Project Management	4	4	50	50	100
	Core	CA-505	Lab. on 501,502 &505	4	5	50	50	100
	Elective	CA-506	Project	4	4	50	50	100
	Elective	CA-507	Image Processing	4	4	50	50	100
	Elective	CA-508	E-Commerce	4	4	50	50	100
	Elective	CA-509	Mobile Computing	4	4	50	50	100

Minimum Credit : 25 , Maximum Credit 33 . Core Subject is compulsory, From elective courses student can select one course for Minimum credit and Three for Maximum Credit. IA- Internal Assessment, UE –University Examination.

Year/ Semester	Subject	Paper	Title of Paper	Hours / Week	Credit	% of Assessment		
						IA	UE	Total
III Year Sem-VI	Core	CA-601	Industrial Training /Institutional project	--	17	25	75	100
	Elective	CA-602	Software Testing & Quality Assurance	4	4	50	50	100
		CA-603	Embedded Systems	4	4	50	50	100
		CA-604	Information Security And Audit	4	4	50	50	100
		CA-605	Cloud Computing	4	4	50	50	100

Core Subject is compulsory. If student had completed 133 credit within Five semesters then no need to select any elective course. Otherwise student should select required elective courses to complete 150 credit.

M.C.A. (Science) –I Semester-I
CA101: Programming with C

Objectives :-
i) To develop Problem Solving abilities using computers
ii) To teach basic principles of programming
iii) To develop skills for writing programs using 'C'

1. Introduction to Programming **[3-5]**

1.1 Problem Solving
- Algorithms, Flowcharts

1.2Programming Languages
Machine language, Assembly language, Assembler, Higher level language, Compiler and Interpreter

2. Introduction to C **[1-2]**

2.1 Structure of a C program
2.2 Functions as building blocks
2.3 C Program development life cycle

3. C tokens **[2-3]**

3.1 Keywords
3.2 Identifiers
3.3 Variables
3.4 Constants – character, numeric, string, escape sequences
3.5Data types – built-in and user defined
3.6 Operators and expressions - types (arithmetic, relational, logical, assignment, bitwise, Conditional, other operators) , precedence and associativity rules.

4. Input and Output **[2-3]**

4.1 Character input and output
4.2 String input and output
4.3 Formatted input and output

5. Control Structures **[7-8]**

5.1 Decision making structures: if, if-else, switch
5.2 Loop Control structures:while, do-while, for
5.3 Nested structures
5.4 break and continue

6. Functions in C **[6-7]**

6.1 Functions, advantages
6.2 Standard library functions

6.3 User defined functions: declaration, definition, function call, parameter passing, return Keyword,
6.4 Scope of variables, storage classes
6.5 Recursion

7. Arrays **[4-5]**

7.1 Declaration, initialization
7.2 One, two and multidimensional arrays
7.3 Passing arrays to functions

8. Pointers **[5-6]**

8.1 Declaration, initialization
8.2 Dereferencing pointers
8.3 Pointer arithmetic
8.4 Pointer to pointer
8.5 Arrays and pointers
8.6 Functions and pointers – passing pointers tofunctions, functions returning pointers.
8.7 Dynamic memory allocation

9. Strings **[4-5]**

9.1 Declaration and initialization
9.2 Standard library functions for String handling
9.3 Strings and pointers
9.4 Array of strings.
9.5Command line Arguments

10. Structures and Unions **[5-6]**

10.1 Creating structures
10.2 Accessing structure members (dot Operator)
10.3 Structure initialization
10.4 Array of structures
10.5 Passing structures to functions
10.6 Nested structures
10.7 Pointers and structures
10.8 Self referencing structure
10.9 Unions
10.10 Difference between structures and unions

11. C Preprocessor **[1-2]**

11.1 Format of Preprocessor directive
11.2 File Inclusion directive
11.3 Macro substitution, nested macro, augmented macro

12. File Handling **[4-5]**

12.1 Streams

12.2 Types of Files
12.3 Operations on files
12.4 Random access to files
12.5 Programing using command line arguments

13. Introduction to Graphics [2-3]

13.1 Initialization graphics

13.2 Graphics Library function – putpixel, getpixel, functions to draw simple geometrical figures.

References

1. How to Solve it by Computer, R.G. Dromey, ISBN:9788131705629, Pearson Education
2. Problem Solving with C, Harrow , ISBN:9788131734391, Pearson Education
3. Programming in ANSI C, E. Balaguruswamy,ISBN:9781259004612,Tata Mc-Graw Hill Publishing Co.Ltd.-New Delhi
4. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, ISBN:9788120305960, PHI Learning
5. A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg ISBN:9788131500941, Cengage Learning India
6. Programming in C (2nd Edition) by Ashok Kamthane, Pearson
7. C Programming by YashwantKanitkar,BPB Publication
8. "Simplifying C", Harshal *A*. Arolkar *and* Sonal Jain, Wiley IndiaDreamtech Press, August 2010. (ISBN: 978-93-5004-049-2)
9. Using the GNU Compiler Collection, Richard M. Stallman, GCC Developer community ISBN:9781441412768,Createspace

CA102: Database Management System

Sr. No.	Chapter No.	Name of Chapter and Contents	No. of Lect.	Reference
1	1	**Introduction to Database Systems** 1.1 Introduction 1.2 Basic Concepts and Definition 1.2.1 Data 1.2.2 Information 1.2.3 Data Versus Information 1.2.4 Data warehouse 1.2.5 Metadata 1.2.6 Data Item or Field 1.2.7 Records 1.2.8 Data Dictionary 1.2.9 Database 1.2.10 Database System 1.3 Database Users and Database Administrator 1.4 Functions and Responsibilities of DBA 1.5 File-oriented System versus Database System 1.6 View of Data 1.7 Database Languages 1.8 Schemas, Sub-schemas and Instances 1.9 3-Level Architecture 1.9.1 Internal Level 1.9.2 Conceptual Level 1.9.3 External Level 1.10 Data Independence 1.10.1 Physical Data Independence 1.10.2 Logical Data Independence 1.11 Structure of a DBMS 1.12 Functions of DBMS 1.13 Data Models	3-5	1,2

2	2	**Physical Data Organization** 2.1 Introduction 2.2 Physical Storage Media 2.3 RAID Technology 2.4 Basic concepts of File 2.4.1 File Types 2.4.2 Buffer Management 2.4.3 File organization 2.5 Indexing	2-4	1,2
3	3	**Relational model** 3.1 Introduction 3.2 Structure of Relational Database 3.3 Relational Algebra 3.3.1 Selection Operation 3.3.2 Projection Operation 3.3.3 Union Operation 3.3.4 Cartesian Product Operation 3.3.5 Difference Operation 3.3.6 Intersection Operation 3.3.7 Division Operation 3.3.8 Rename Operation 3.3.9 Join operation	5-7	1,2
5	5	**SQL** 4.1 Introduction 4.2 Basic Structure 4.3 Aggregate Functions 4.4 Null Values 4.5 Nested Subqueries 4.6 Views 4.7 Complex Queries 4.8 Modification of Database 4.10 Integrity and Security Constraints 4.11 Security and Authorization	7-11	2,4
4	4	**Database and Relational Database Design** 5.1 Introduction 5.2 Basic E-R Concepts 5.3 keys 5.4 Constraints 5.5 Entity Set	8-10	1,2

		5.5.1 Strong Entity Set		
		5.5.2 Week Entity Set		
		5.6 E-R Diagram Symbol		
		5.7 E-R Diagram		
		5.8 Extended E-R Features		
		5.9 Conversion of E-R Model into Relations		
		5.10 Functional Dependency		
		5.11 Full Functional Dependency		
		5.12 Armstrong's Axioms		
		5.13 Redundant Functional Dependencies		
		5.14 Closures of a set of Functional Dependencies		
		5.15 Decomposition		
		5.16 Normalization		
		5.17 Normal forms		
		5.17.1 First Normal Form		
		5.17.2 Second Normal Form		
		5.17.3 Third Normal Form		
		5.17.4 Boyce-Codd Normal Form (BCNF)		
		5.17.5 Fourth Normal Form		
		5.17.6 Fifth Normal Form		
6	6	**Transaction Management**	4-6	1,2
		6.1 Transaction Concepts		
		6.2 Transaction Properties		
		6.3 Transaction States		
		6.4 Concurrent Execution		
		6.5 Serializability		
		6.6 Recoverability		
7	7	**Concurrency Control & Database Recovery System**	10-12	1,2
		7.1 Introduction		
		7.2 Lock based Protocols		
		7.2.1 Locks		
		7.2.2 Granting of locks		
		7.2.3 Two Phase Locking Protocol		
		7.2.4 Time Stamp-Based protocol		
		7.2.5 Thomas Write Rule		
		7.2.7 Multiple Granularity		
		7.2.8 Deadlock Handling		
		7.3 Database Recovery Concepts		
		7.4 Types of Database Recovery		
		7.5 Recovery Technique		

7.5.1 Deferred Update

7.5.2 Immediate Update

7.6 Buffer Management

Recommended Books:

- Database Systems: Concepts, Design and Applications, Singh, ISBN:9788131760925, Pearson
- Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, ISBN: 9780072465631, TMH
- Database Systems Concepts, Abraham Silberschatz, Henry Korth, S. Sudarshan, ISBN: 9780071244763, TMH
- Database Systems, Connolly, ISBN:9788131720257, Pearson
- A Guided Tour of Relational Databases and Beyond, Levene, ISBN:9788181280510, Springer
- Fundamentals of Database Management Systems, Gillenson, ISBN:9788126517930, Wiley India
- Database Design and Relational Theory C.J. Date, ISBN:9789350237298,O'Reilly
- An Introduction to Database Systems, Date/Kanna, ISBN, 9788177585568 , Pearson
- Fundamentals of Database Systems, Elmasri, ISBN:9788131716250 , Pearson
- Database-Principles, Programming and Performance, O'Neil, ISBN:9789380501284, Elsevier
- Database System Implementation, Garcia-Molina, ISBN:9788131704134, Pearson

CA 103- Mathematical Foundation

1. **SET THEORY** [5To 7 Lectures]
1.1 Sets, Subsets
1.2 Operations on Sets
1.3 De Morgan's Laws
1.4 Power Set of a Set
1.5 Cartesian Product
1.6 Equivalence relation
1.7 Partition of a Set
1.8 Partial order on a set

2 PROPOSITIONAL CALCULUS [4 To 5Lectures]
2.1 Propositions
2.2 Logical connections
2.3 Truth tables
2.4 Logical equivalence
2.5 Tautology and contradiction

3**PREDICATE CALCULUS** [5To 6 Lectures]
3.1 Predicates
3.2 Valid arguments and proofs.
3.2.1 Proofs using truth tables
3.2.2 Direct proof
3.2.3 Indirect proof
3.3 Quantifiers(up to two variables)

4**. INTRODUCTION TO ALGEBRA**
Relations and Functions [7 To 8 Lectures]
4.1 Ordered Pairs, Cartesian product of Sets.
4.2 Relations, types of relations, equivalence relations, Partial Ordering.
4.3 Equivalence Class, Properties of Equivalence Class.(without proof)
4.4 Definition of function as relation
4.5 Injective, Surjectivefunction ,Bijective function
4.6Composition of two functions, Inverse Function

5. **INTEGERS** [12To 14 Lectures]
5.1 Divisibility of Integers
5.2 Definition and Properties
5.3.Division Algorithm
5.4 Divisibility and its properties
5.5 GCD, Euclidean Algorithm
5.6 Properties of GCD
5.7 Modular Arithmetic

5.7.1 Congruence relation
5.7.2 Euler's theorem statement and examples
5.7.3 Definition of binary operation
5.7.4 Composition table

6**POLYNOMIALS** [5 To 6 Lectures]

6.1 Definition of polynomial, Equality, addition, multiplication of two polynomials
6.2 Divisibility in Polynomials, Properties of divisibility
6.3 GCD of two polynomials using Euclidean Algorithm
6.4 Roots of a polynomial(by A.P,G.P)

7**PERMUTATION** [4To 5 Lectures]

7.1 Definition of permutation
7.2 Multiplication of two permutations
7.3 Cycle, transposition
7.4 Even and odd permutation

8**. Matrices** [6 To 9Lectures]

8.1 Definition of matrix
8.2 Matrix operations
8.3 Transpose and powers of matrices
8.4 Symmetric matrix
8.5 Inverse of a matrix(by adjoint method)
8.6Echelon form of the matrix
8.7 Solving system of linear equations using

- Cramer's rule
- Inverse
- Guass elimination method

Reference Books :

1.
2. Discrete Mathematical Structures : Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, Nadeen-Ur-Rehman.
3. Discrete Mathematics And Its Applications: Rosen
4. M Artin, Algebra,prentice hall of India , New Delhi(1994)
5. Elementary linear algebra : Howard Anton
6. Discrete Mathematics Rajendra Akerkar , Rupali Akerkar Pearson Publication
7. Discrete Mathematics with Applications, Thomas Koshy, Elsevier Academic Press, ISBN: 9788181478870
8. Discrete Structures, Logic, and Computability, James Hein, Jones & Barlett Student Edition, ISBN:9789380108391

CA -104 Concrete Mathematics and Graph Theory

Graph Theory

1. Graphs

Definition and examples of graphs, Incidence and degree, Handshaking lemma, Isomorphism, Sub-graphs, Walks, Path, Circuits, Connected and disconnected graphs, Euler graphs, Operations on graphs. Hamiltonian Graphs, Traveling Salesman problem (Reference Book No.1. Chapter 1, 2)

Algorithms: Connectedness algorithm, Shortest Path Algorithm (Reference Book No. 1., Chapter 11) ,Fleury's Algorithm, Chinese Postman problem, Product of two graphs, Complement of a graph, Self Complement of a graph(Reference Book No.5) (8-10 Lectures)

2. Trees

Definition and properties of trees, Pendent vertices, centre of a tree, Rooted and binary tree, spanning trees, minimum spanning tree algorithms, Fundamental circuits, cutsets and cut vertices, fundamental cutsets, connectivity and separativity, max-flow min-cut theorem (Reference Book No. 1. Chapter 3, 4 for max-flow, min-cut theorem, Chapter 14) (8-10 Lectures)

3. Planar Graphs

Planar Graphs, Kuratowski's graphs, (Reference Book No.1. Chapter 5) (2 Lectures)

4. Matrix Representation of Graphs

Incidence, Adjacency Matrices and their properties

(Reference Book No.1. Chapter 7) (2 Lectures)

5. Coloring

Chromatic Number, Chromatic Polynomial, (Reference Book No. 1. Chapter 8) (2 Lectures)

6. Directed Graphs

Types of digraphs, directed paths and connectedness, Euler digraphs, Directed trees, Arborescence, Tournaments, Acyclic digraphs, Polish notations.

(Reference Book No. 1. Chapter 9) (5-6 Lectures)

Concrete Mathematics

1. Cryptography and Number Theory

Cryptography and Modular Arithmetic, Private Key Cryptography, Public-key Cryptosystems, Arithmetic modulo n, Cryptography using multiplication mod n, Inverses and GCD, Solutions to

Equations and Inverses mod n, Inverses mod n, Converting Modular Equations to Normal Equations, Greatest Common Divisors(GCD), Euclid's Division Theorem, The GCD Algorithm, Extended GCD algorithm, Computing Inverses, The RSA Cryptosystem, Exponentiation mod n, The Rules of Exponents, Fermat's Little Theorem, The Chinese Remainder Theorem , Applications(Reference Book No.6. and No.7) (15-18 lectures)

2. Recursion

Recursion, First order linear recurrences, Solving recurrences, Exponential generating functions (Reference Book 6, 7) (6-8 lectures)

References:

1. Graph Theory with Applications to Engineering and Computer Science, Deo, Narsing [1974], Prentice Hall
2. Concrete Mathematics, A Foundation for Computer Science, Graham R.M., D.E.Knuth [1989], Addison Wesley.
3. Graph Theory with Applications, Bondy, J. A. & U. S. R. Murty [1976], MacMillan
4. Graph, Networks and Algorithms, Swamy, M. N. S. & K. Tulsiram [1981], John Willey
5. A First Look at Graph Theory, John Clark, D.A .Holton.
6. A Course in Number Theory and Cryptography Second Edition by Neal, Koblitz.(Springer).
7. Discrete Mathematics for Computer Scientists-Clifford Stein, Kenneth Bogart, Robert Drysdale, Pearson Publication.

CA- 105 Computer Organizations

1. **Digital Circuits** **[14-15]**
   - Gates - Basic gates , derived gates, positive and negative logic 2
   - Simplification of logic circuits, De-Morgans theorem, Concept of K map and simplification of sungle expressions (upto 4 variables) 2
   - Combinational circuits 1
   - Half adder, full adder, half subtractor 1
   - Multiplexer (4 to 1), Demultiplexer (1 to 4) using AND-OR gates, AND gates 2
   - Encoder - Decimal to BCD 1
   - Decoder - 3 to 8 decoder using gates 1
   - Sequential circuits - concept of flip flop, need for clock, concept of triggering 1
   - SR, JK, D and T flip flops 2
   - Concept of counter, types, concept of registers, types and applications 2

2. **CPU Organization** **[4-6]**
   - Functions of CPU 1
   - General registers used in CPU -PC, SP, instruction pointer, instruction register, instruction decoder, flag, general purpose registers, memory address register, memory byte register 2
   - General register organization of CPU 1
   - Concept of stack, instructions used with stack 1
   - Block diagram of ALU 1

3. **Memory organization** **[8-9]**
   - Memory hierarchy 1
   - Use of cache memory, address mapping with cache 2
   - Associative memory 2
   - Virtual memory 2
   - Memory management through segmentation and paging 1

4. **I/O Organization** **[13-14]**
   - Interfacing concept and need, general structure of an interface, block diagram of parallel interface and function of blocks 2
   - Concept of interrupt, IVT, size of IVT and processor response 1
   - Types of I/O transfer, CPU initiated, interrupt initiated, DMA (only concept) 2
   - Data convertors - DAC, ADC (flash, successive approximation and dual slope ADC) 3
   - Serial communication and types 2
   - Working of UART with block diagram, Serial communication standards USB 2

- PCI bus standard 1

5. Architecture of Microprocessor [3-5]

- Block diagram of 8086 and function of blocks 1
- 8086 Registers 2
- Numeric co-processor - Concept , block diagram and functions of blocks 2

6. Parallel Processing [9-11]

- Concept of parallelism 1
- Parallel computer structures 2
- Concept of pipelining, Pipelined computers 1
- Instruction pipeline, Arithmetic pipeline 2
- Concept of RISC and CISC 2
- RISC pipelining 1

Reference Books:

1. Electronic Principles, Tata McGraw-Hill, 7th Edition by Albert Malvino and David Bates
2. Modern Digital Electronics, 3 edition, R P Jain
3. Digital Design 4e, Mano, ISBN:9788131714508, Pearson
4. Digital Logic & Computer Design, Mano, ISBN:9788177584097, Pearson
5. Computer Systems Organization & Architecture- John D. Carinelli Pearson publication.
6. Digital Design and Computer Architecture 2nd Edition , Harris, Morgan Kauffman Publishers(Elesevier) ISBN:9789382291527

M.C.A. (Science) –I Semester-II
CA 201: Data Structures

Objectives :-

i) To understand the different methods of organizing data in computer memory.
ii) To efficiently implement the different data structures.
iii) To efficiently implement the solutions for specific problems.

0. Prerequisites

Concept of Structures and pointers

1. Introduction to Data Structure **[2-3]**

1.1 Concepts
1.2 Data types, ADT (Abstract Data Type)
1.3 Types of data structure

2. Algorithm Analysis **[2-3]**

2.1 Space complexity
2.2 Time complexity
2.3 Asymptotic Notations (Big O, Omega, Theta)

3. Linear data structure **[6-8]**

3.1 Array as linear data structure
3.2 Representation of array in memory
- Row major, Column major

3.3 Sorting Algorithms & their time complexity
- Bubble, Insertion, Quick, Merge sort

3.4 Searching Algorithms & their time complexity
- Linear Search, Binary Search

4. Linked List **[8-10]**

4.1 Introduction
4.2 Types – Singly, doubly, singly circular, doubly circular
4.3 Dynamic representation.
4.4 Operations on linked list.
4.5 Generalized Linked List – Concept & representation.
4.6 Applications
- Polynomial representation, addition of two polynomials

5. Stack **[6-8]**

5.1 Introduction
5.2 Representation : static and dynamic
5.3 Operations on stack.
5.4 Applications

- Convert expression Infix to Postfix, Infix to Prefix
- Evaluation of Postfix and Prefix expression

5.5 Concept of multiple stacks

6. Queue **[6-7]**

6.1 Introduction
6.2 Representation: static and dynamic
6.3 Operations on queue
6.4 Circular queue, priority queue, DeQue
6.5 Concept of multiple queues.

7. Tree **[10-11]**

7.1 Concept & terminologies
7.2 Binary tree
- Representation: static and dynamic
- Types: full, complete, skewed.
- Traversal: inorder, preorder, postorder.

7.3 Binary Search Tree
- Concept & Operations: create, insert, delete.

7.4 Height balanced tree – AVL tree, rotations(No programming implementation)
7.5 Application
- Heap Sort, Expression tree

8. Graph **[6-7]**

8.1 Concept & terminologies
8.2 Representation: Adjacency matrix, Adjacency list.
8.3 Traversal: DFS, BFS
8.4 Spanning tree, minimum cost spanning tree,
Prim's Algorithm and Kruskals Algorithm (No programming implementation)
8.5 Applications
- AOV network, topological sort
- AOE network, critical path
- Shortest path: Dijkstra's algorithm .

9. Hashing **[2-3]**

9.1 Hash table concepts
9.2 Hash functions
9.3. Overflow handling techniques (No programming implementation)

References:

1. Data Structures Using C, ISBN:9788131722381,Bandyopadhyay,Pearson
2. Introduction to Data Structures in C, ISBN:9788131713921,Kamthane,Pearson
3. Data Structures and Program Design in C , ISBN:9788177584233,Kruse,Pearson\
4. Data Structures Using C, ISBN:9788131702291,Tenenbaum,Pearson
5. Data structures and Algorithm Analysis in C, 2e, ISBN:9788177583588,Weiss,Pearson
6. Fundamentals of data structures – Ellis Horowitz and Sartaj Sahani (Galgotia)
7. Data Structures and Algorithms, ISBN: 9788177588262, Aho, Pearson
8. Data Structure and Algorithm, Maria S. Rukadikar, ISBN:9789350235553, Shroff

CA- 202: Theoretical Computer Science

1) Preliminaries [2-3 Lectures]
   - Symbol, Alphabet, String, Prefix& & Suffix of Strings, Sets, Operations on sets, Finite & infinite sets, Russell's Paradox, Cator's Diagonal Argument, Formal Language
   - Relation, Equivalence Relation,(reflexive, transitive and symmetric closures)
   - Principle of Induction
2) Regular Languages [14-16 Lectures]
   - Regular Expression: Definition, Examples, & Identities
   - Finite Automata: Concept
   - DFA: Definition & examples
   - - NFA: Definition, examples, Language accepted By FA, NFA with ∈- moves
   - Regular Expression to FA: Method and Problems
   - NFA with ∈- moves to NFA,
   - NFA to DFA: Method Problems
   - Minimization of DFA: Problem using Table Method
   - FA with output: Moore & Mealy Machines:
   - Definition and their equivalence
   - Application of FA: Pumping Lemma & Examples
   - Closure Properties: Union, Intersection,
   - Concatenation, Complement, & Kleene Closure
3) Context Free Languages [15-17 Lectures]
   - Chomsky Hierarchy
   - CFG : Definition & examples
   - Ambiguous Grammar : Concept & Examples
   - Simplification of CFG : Removing Useless
   - Symbols, removing unit productions and removing Nullable symbols : Methods & Problems
   - Normal Forms : CNF & GNF : Method & Problems
   - Regular Grammar : Definition ,Equivalence of FA & Regular Grammar
   - PDA : Basic Concept , Definition (DPDA & NPDA)
   - Construction of PDA using empty stack and final
   - State method : Examples using stack method
   - Equivalence between acceptance by final state
   - And Empty stack method & examples
   - Equivalence between PDA & CFG (in GNF): Method and examples
4) Properties of Context Free Languages [1-2 Lectures]
   - Pumping Lemma for CFL : methods & problems
   - Closure Properties of CFL's(Union,
   - Concatenation, & Kleene Closure) : Method & Examples)
5) Turing Machine [9-11 Lectures]
   - Recursive & recursively enumerable language
   - Introduction to LBA (Basic Model) & CSG.
   - Definition Of TM,
   - Design of TM for language recognition

- Types of Turing Machine (Multitape TM, NonDeterministic TM,Universal TM, Restricted TM)
- Undecidable Problem, Halting Problem of TM
- Simple Arithmetic Problems on Unary Numbers using TM

References:

1. Introduction to Automata Theory , Languages ,And Computation (2nd Edition Pearson education) By –John E. Hopcroft , Rajeev Motwani, Jeffrey D. Ullman
2. An Introduction to Formal Languages and Automata, Peter Linz, Jones & Barlett Student Edition, ISBN: 9789380853284
3. Fundamentals of Theory of Computation, Principals and Practice, Greenlaw, Hoover, Elsevier, ISBN:9781558604742
4. Introduction to Computer Theory By - Daniel I.A. Cohen (John Wiley & Sons (ASIA) Pre Ltd. 2nd Edition)
5. An Introduction to the Theory of Computer Science Languages & Machine (3rd Edition Pearson education) By Thomas A. Sudkamp
6. Introduction to Languages and the theory of Computation By – John C.Martin (Tata McGraw –Hill Edition, 2nd Edition)
7. Theory of Computer Science (Automata Languages And Computation By – K.L.P.Mishra & N. Chandrasekaran (Prentice –Hall India 2nd Edition)
8.

CA-203 Object Oriented Programming (C++)

Prerequisites

To study object oriented programming concepts and programming it is important to students must have knowledge of C programming language. The object oriented features include the base of programming language. C++ is the extension of C language. It will be beneficial with the background of C language. Mathematical foundation is an additional advantage.

General Description

This course provides an introduction to object oriented programming concepts using the C++ programming language. The course assumes knowledge in C Language. The course emphasis is on the object orientated facilities of C++ and how they can be used to create structured, modular and re-usable code. C++ is an extension of C language which is widely used all over. It is powerful programming language that combines power, elegance and flexibility of C and the features of object oriented programming. With its object oriented capabilities like data abstraction, inheritance, operator overloading, polymorphism, stream handling. It supports software engineering benefits over C language.

Objectives

To understand the fundamental Object Oriented Concepts.
To solve simple and moderately complex problems using C++.
To understand the implementation of various data structures and algorithms.
To Understand and modify Open Source software written in C and C++.
After completing this course, student will be able to identify the benefits of using C++ and object-oriented programming techniques for application development.

1. Introduction to C++ **2-4 lectures**

Starting with C++
How C++ evolved from C?
Features of C++
Procedure-oriented programming
OOP vs. procedure-oriented programming
The basic anatomy of a C++ program
Starting with a simple "Hello World" program
Compiling, linking and running a C++ program

2. Object-Oriented Programming Concepts **3-4 lectures**

Abstraction
Inheritance
Polymorphism

Data Binding
Encapsulation
Classes and Objects

3. Introduction to C++ programming **10-11 lectures**

Data Types, new operators and keywords, Type casting in C++, reference variables, arrays etc.
Classes and Objects
Classes and Access Specifiers
Defining data members and member functions
Array of objects
Usage of namespace
Managing Console I/O
Usage of Manipulators
Static Members
Call by reference, return by reference
Inline Function
Friend Function
Function overloading

4. Constructer & Destructor **2-4 lectures**

Introduction
Types of constructor
Destructor

5. Operator Overloading **8 -9 lectures**

Overloading unary and binary operators
Usage of this pointer
Overloading using friend functions
Overloading "<<" and ">>" operator
Type Conversion

6. Inheritance **6-8 lectures**

Introduction
Types of Inheritance
Base class and derived class examples
Virtual base class
Abstract class
Polymorphism
Virtual functions and pure virtual functions
Overriding

7. Files **6-8 lectures**

Classes for file stream operations1
Opening and closing a file

Detecting end of file
File pointers and their manipulations
File updation with random access

8. Templates **2-4 lectures**

Defining templates
Function templates
Derivations and templates
Examples of templates

9. Exception Handling **1-2 lectures**

Introduction
Exception handling mechanism

Reference Books :

[1] Object Oriented Programming (C++) – Balaguruswamy
[2] The C++ Programming Language - Bjarne Stroustrup
[3] Thinking in C++ - Bruce Eckel
[4] C++ Programming Today – Barbara Johnstron
[5] Problem Solving with C++ - Walter Savitch
[6] Object Oriented Programming with C++, Mahesh Bhave, Sunil Patekar Pearson Publication

CA-204: Computer Networks

Total no. of lectures- 50

Ch no	Title	Total Lectures	Reference Books
1	**Introduction to Computer Networks**	5-6	
	Data Communication . characteristics of data communication, components, data representation, data flow.		Forouzan Ch.1
	Computer Networks Distributed processing, Physical structure-Point to Point, Broadcast, Categories of topology (mesh,star,ring,bus,etc.)		
	Categories of network LAN,WAN,MAN,INTERNET etc.		
	Protocols and Standards Definition of protocol, key elements , Defacto & Dejure standard, Standards organizations.		
	Network Software Protocol Hierarchies layers, protocols, peers, interfaces, network architecture, protocol stack design issues of the layers – addressing, error control, flow control, multiplexing and de-multiplexing, routing Connection-oriented and connectionless service . Service Primitives – listen, connect, receive, send, disconnect . The relationships of services to protocol		Tanenbaum Ch. 1
2	**Network Models**	3-4	
	OSI Reference model Functionality of each layer **TCP/IP model**		Forouzan Ch.2

	Introduction to IP,TCP & UDP TCP/IP Protocol Suite **Addressing** Physical, Logical & Port addresses		
3	**The Physical Layer**	7-8	
	The Basic Concepts of analog & digital signals . Bit rate, bit length, base band transmission . Transmission Impairments – attenuation, distortion and noise Data Rate Limits – Nyquist's bit rate formula for noiseless channel and Shannon's law . Problems on above concepts		Forouzan Ch.3, Forouzan Ch.3
	Performance of the Network Bandwidth, Throughput, Latency(Delay), Bandwidth –Delay Product, Jitter Problems on above concepts		
	Line Coding digital to digital conversion Characteristics, Line Coding Schemes Unipolar, NRZ, RZ, Manchester and Differentia*l* Manchester		Forouzan Ch.4
	Transmission Modes . Parallel Transmission . Serial Transmission – Asynchronous and Synchronous		Forouzan Ch.4
	Multiplexing FDM, TDM, WDM.		Forouzan Ch.6
	Switching Circuit Switching, Message Switching and Packet Switching		Tenenbum ch 2
4	**The Data Link Layer**	3-5	
	Framing . Character Count, Byte Stuffing, Bit Stuffing and Physical Layer Coding Violations **Error Control** Hamming Code and CRC **Elementary data link protocols** Simplex stop & wait protocol, Simplex protocol for noisy channel. **Sliding Window Protocols** . 1-bit sliding window protocols, Pipelining – Go-Back N and Selective Repeat		Tanenbaum ch 3
5	**The Medium Access Sub layer**	3-5	
	Random Access Protocols . ALOHA – pure and slotted		Forouzan Ch.12

	CSMA – 1-persistent, p-persistent and nonpersistent CSMA/CD, . CSMA/CA **Controlled Access** . Reservation, Polling and Token Passing **Channelization** . FDMA, TDMA and CDMA		
6	**Wired & wireless Lans** **Ethernet Standard** . Frame Format, Access Method and Physical Layer . Changes In The Standard – Bridged Ethernet, Switched Ethernet, Full Duplex Ethernet . Fast Ethernet – Goals and MAC Sub layer Specifications . Gigabit Ethernet – goals, MAC Sub layer Specifications **Wireless Lan** Architecture – BSS & ESS	2-4	Forouzan Ch.13 Forouzan Ch.14
7	**The Network layer** **Design Issues** . Store-and-forward packet switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection Oriented Service, Comparison of Virtual Circuit and Datagram **Logical Addressing** . IPV4 Addresses – Address Space, Notations, Classful Addressing, Classless Addressing, Network Address Translation(NAT) IPV6 Addresses – Addressing Structure, Address Space **IPV4 Protocol** . Datagram Format, Fragmentation, Checksum, Options **IPV6 Protocol** . Advantages, Packet Format, Extension Headers **Transition From IPV4 to IPV6** . Dual Stack, Tunneling, Header Translation **Routing Concepts** . Properties of routing algorithm, Comparison of Adaptive and Non-Adaptive Routing Algorithms **Congestion Control**	9-11	Tanenbaum ch 5 Forouzan Ch 19 Forouzan Ch 20 Tanenbum ch 5

	. General Principles of Congestion Control, Congestion Prevention Policies		
8	The Transport layer	5-6	
	Process-to-Process Delivery		Forouzon ch 23
	. Client Server Paradigm, . Multiplexing and De-multiplexing, . Connectionless Vs Connection-Oriented Service, . Reliable Vs Unreliable		
	User Datagram Protocol UDP		Forouzon ch 24
	. Datagram Format, Checksum, UDP operations, Use of UDP		
	Transmission Control Protocol (TCP)		Forouzon ch 23
	. TCP Services, . TCP Features, . TCP Segment, . TCP Connection, . Flow Control, Error Control		
	TCP Congestion Control		
	. Slow Start Mechanism Introduction to SCTP		
9	**The Application layer**	5-7	
	Domain Name System (DNS)		Forouzon ch 25
	Name Space, . Domain Name Space, . Distribution of Name Space, . DNS in the Internet, Name – Address Resolution		
	TELNET		Forouzon ch 26
	. Timesharing Environment, . Logging, NVT, Embedding, Options, . Mode of Operations		
	E-MAIL		Forouzon ch 26
	. Architecture, . User Agent, . Message Transfer Agent-SMTP, . Message Access Agent-POP, IMAP, . Web Based Mail		
	File Transfer Protocol (FTP)		Forouzon ch 26
	. Communication over control connection, . Communication over Data Connection, Anonymous FTP		
	WWW		Forouzon ch 27
	. Architecture, . WEB Documents		
	HTTP		Forouzon ch 27

- HTTP Transaction,
- Persistent and Non-persistent Connection,
- Proxy Server

Reference Books:

1. Computer Networks, Tanenbaum, ISBN:788177581652, Pearson
2. Data Communication and Networking by Behrouz Forouzan, TATA McGraw Hill.Fourth edition
3. Computer Networking and the Internet,Halsall / Kulkarni, ISBN:9788177584752, Pearson
4. Data Communications and Networks: An Engineering Approach, Irvine, Wiley India, ISBN:9788126507658
5. Elements of Network Protocol Design, Gouda, ISBN:9788126516476, Wiley India
6. Computer Networks-A Systems Approach, 5e , Peterson, ISBN :9789380501932, Elsevier

CA-205: Advance Database Concepts

Chapter No.	Topics	No. of Lect.	Ref. Books
1	Object-Oriented Databases 1.1 Introduction 1.2 Object-Oriented data model Characteristics of Object-Oriented databases Comparison of an OOMD and ER model 1.3 Concepts of OODB Objects Object Identity Object Attributes Classes Relationship or Association among objects Structure, Inheritance and Generalization Operation Polymorphism Advantages of OO Concept 1.4 Object-oriented DBMS(OODBMS) Features of OODBMSs Advantages of OODBMSs Disadvantages of OODBMSs 1.5 Object Data Management Group(OMDG) and Object-oriented languages Object Model Object Definition Languages(ODL) Object Query Languages(OQL)	7-9	Book 1, 2
2	Object-Relational Database 2.1 Introduction 2.2 History of Object-relational DBMS(ORDBMS) Weekness of RDBMS Complex Objects Emergence of ORDBMS 2.3 ORDBMS Design Challenges of ORDBMS Features of ORDBMS Comparison of ORDBMS and OODBMS Advantages of ORDBMS Disadvantages of ORDBMS	3-5	Book 1
3	Database Security 3.1 Introduction 3.2 Goals of database security Threats to database security Types of database security issues Authorisation and authentication	6-8	Book 1

	3.3 Discretionary Access control Granting/Revoking privileges Audit Trails 3.4 Mandatory access control 3.5 Firewalls 3.6 Statistical database Security 3.7 Data Encryption Simple substitution method Polyalphabetic substitution method		
5	**Parallel Database Systems** 1.1Introduction 1.2Parallel Databases Advantages , Disadvantages 1.3Architecture of parallel Databases Shared-memory Multiple CPU Parallel Database Architecture Shared-disk Multiple CPU Parallel Database Architecture Shared-nothing Multiple CPU Parallel Database Architecture 1.4 Key Elements of Parallel Database Processing Speed – up Scale- up Synchronization Locking 1.5 Query Parallelism I/o Parallelism (Data Partitioning) Intra-query Parallelism Inter –Query Parallelism Intra Operation Parallelism Inter Operation Parallelism	6-8	Book 1, 2
	Distributed Database Systems 2.1 Introduction 2.2 Distributed Databases Difference between Parallel and distributed databases Desired properties of Distributed Databases Types of Distributed Databases Desired function of Distributed Databases Advantages & Disadvantages of Distributed Databases 2.3 Distributed Database System Design Data Fragmentation , Data Replication, Data Allocation 2.4 Concurrency control in Distributed database	8-10	Book 1, 2

	Distributed Locking, Distributed Deadlock, Timestamping 2.5 Recovery control in Distributed database 2- Phase Commit Protocol		
6	**Multimedia Databases** Multimedia Sources Multidatabase Queries Multidabase Applications **Mobile Databases** Architecture Characteristics of mobile computing Mobile DBMS Commercial MD **Spatial Databases** Spatial Data Spatial Database Characteristics Spatial Data Model Spatial Database Queries **Introduction to Big-data and its applications**	6-8	Book 1, 2

Reference Books :-

1) Database Systems: Concepts, Design and Applications, Singh, ISBN:9788131760925, Pearson
2) Database Systems Concepts, Abraham Silberschatz, Henry Korth, S. Sudarshan, ISBN: 9780071244763, TMH
3) Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, ISBN: 9780072465631, TMH
4) Advanced Database Management system, Chakrabarti, ISBN: 9788177228021, Wiley India