Master of Computer Application

Name of Program	Master of Computer Application
Abbreviation	MCA
Duration	3 Years (Regular) 2 Years (Lateral Entry)
Eligibility	3 Years (Regular) : Recognized Bachelor's Degree of minimum 3 year duration with Mathematics at 10+2 level or at Graduate Level. 2 Years (Lateral Entry) : Recognized Bachelor's Degree of minimum 3 Yrs.duration in BCA, B.Sc (IT/Computer Science) with Mathematics as a course at 10+2 level or at Graduate Level.
Objective of Program	The core objective of the MCA programme is to prepare the students for productive career in software industry and academia by providing an outstanding environment of teaching and research in the core and emerging areas of the discipline.
Program Outcome	It will prepare the students to obtain positions as System Analysts, System Designers, Programmers , IT Managers and academicians in any field related to Information technology.
Medium of Instruction	English
Program Structure	Semester 1

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
101	Computer Organization and Fundamentals of Operating Systems	4	0	4	3 Hrs	70	30	100
102	Database Management System	4	0	4	3 Hrs	70	30	100
103	Computer Programming and Programming Methodology	4	0	4	3 Hrs	70	30	100
104	Enterprise Resource Planning & Financial Management	4	0	4	3 Hrs	70	30	100
105	Mathematical Foundation Of Computer Science	4	0	4	3 Hrs	70	30	100
106	Software Lab	0	5	5	2 Hrs	70	30	100
107	Programming Skills – I	0	5	5	2 Hrs	70	30	100
	Total	20	10	30	19 Hrs	490	210	700

Program Structure	Semester 2

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
201	Object Oriented Programming Methodology	4	0	4	3 Hrs	70	30	100
202	Data Structures	4	0	4	3 Hrs	70	30	100
203	Relational Data Base Management System	4	0	4	3 Hrs	70	30	100
204	Optimization Techniques	4	0	4	3 Hrs	70	30	100
205	Computer Network	4	0	4	3 Hrs	70	30	100
206	Programming Skills – II	0	3	3	2 Hrs	70	30	100
207	Programming Skills – III	0	3	3	2 Hrs	70	30	100
208	Programming Skills – IV	0	4	4	2 Hrs	70	30	100
	Total	20	10	30	21 Hrs	560	240	800

MCA 1st Semester

Course: 101: Computer Organization and Fundamentals of Operating Systems

Course Code	101
Course Title	Computer Organization and Fundamentals of Operating Systems
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course is an introduction to students to understand fundamentals of computer. The course also gives students an idea about various components of computer, hardware and its working. The course also explains the concept of various operating systems, their use, architecture and its working.
Course Objective	1. To make students understand computer hardware fundamentals 2. To make students understand various components of computer and their working 3. To make students understand the importance and use of operating system 4. To explain various types of operating system architecture
Pre-requisite	Nil
Course Out come	After studying the course, students will be able to understand how computer works and the importance of various components of computers. This course will also help students to appreciate the role of various operating systems. After successful completion, students will be able to select particular configuration of computer and operating system necessary for the application.
Course Content	Unit 1. Memory, Number System & Basic Computer Architecture 1.1 RAM, ROM, PROM, EPROM etc, Virtual Memory, Cache Memory 1.2 Secondary Storage Devices 1.3 Binary, Hexadecimal, Octal Number System 1.4 Integer & Floating Point representations 1.5 Coding Schemes – ASCII, EBCDIC, UNICODE 1.6 Block Diagram of CPU and execution process. 1.7 Introduction to bus architecture 1.8 H/W parts of PC 1.9 Disk Architecture 1.10 I/O devices: Keyboard, Display, Pointing devices, MODEM, Scanners, OMR, OCR, CD-ROM, DVD, printers.

	Unit 2. Operating System Concepts 2.1 Evolution of Operating System & History 2.2 Needs of an Operating System 2.3 Single User & Multi-User Operating System 2.4 Elements of an Operating System Unit 3. Single User Operating System 3.1 BIOS, POST Operation, Vector Table, Device Drivers, TSR Programs 3.2 System Files 3.3 Configuration Files Unit 4. Multiuser Operating System 4.1 Introduction to Windows-NT, UNIX/LINUX 4.2 Architecture of Windows-NT and UNIX 4.3 Booting process of Windows and UNIX 4.4 UNIX Commands Unit 5. Introduction to System S/W Components 5.1 Assemblers 5.2 Compilers 5.3 Linker & Loader [Self Study] Comparison of two multiuser OS
Reference Books	1. Fundamentals of Computer – V. RajaRaman 2. How Computers work - Ron White – Techmedia 3. Introduction to computers:- Peter Norton – TMH 4. Understanding Operating Systems - 4th Ed- Flynn – Thomson Course Technology 5. Inside IBM PC - Peter Norton - PHI 6. Unix Concepts And Application - Das – McGrawHill 7. MS DOS 6.22 – Comdex Computer Publishing 8. Netware for dummies - Dummy Series 9. Advanced MSDOS - Ray Duncon - McGraw Hill 10. Advanced Unix -A Programmer's Guide - Stephen Prata - SAMS 11. User Manual of DOS, Windows-Windows-NT, Netware 12. Operating Systems - Stallings – PHI 13. System Programming & Operating System – Dhamdhere- TMH 14. Compilers Principles Techniques & Tools – Aho A – Addison Wesley
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 102: Data Base Management System

Course Code	102
Course Title	Data Base Management System
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course introduces the fundamentals of Database Management System. The course includes the basic of various DBMS's like Access, Mysql and DB2.

Course Objective	1. To make students understand Structured Query Language 2. To get students acquainted with various DBMSs 3. To make students understand and implement the Normalization process.
Pre-requisite	Basic computer fundamentals
Course Outcome	After studying the course, students will be able to understand how to work with DBMS and SQL. This course will also help students to learn normalization and various aspects of Data Base Management System and will also be able to execute SQL queries.
Course Content	Unit 1. Basic Concepts of Database Management System. 1.1 Fundamental concepts of File and databases 1.2 Purpose of database system 1.3 Introduction to Data models 1.3.1 Conceptual Data model – E- R model 1.3.2 Record based Data models – Hierarchical, Relational, Network 1.4 Features of Database Systems 1.4.1 Data abstraction & Data independence 1.4.2 Type of Database Languages: DDL, DML,TCL 1.4.3 Database users: Database manager, administrator and Users 1.4.4 Overall system structure. Unit 2. Structure of relational database model and Integrity Constrains 2.1 Relation scheme, Relation, Views 2.2 Notion of Keys 2.3 Pure query language: relational algebra 2.4 Domain Constrains, key Constrains, Referential Integrity Constrains 2.5 Functional Dependencies Unit 3. Relational Commercial Language - SQL Unit 4. Commercial RDBMS: Microsoft Access, DB2 & MySQL 4.1 Basic Architecture of DBMS 4.2 Working with databases and tables. 4.3 Managing constrains and relationships. 4.4 Using SQL queries. Unit 5. Relational Database Design 5.1 Pitfalls in relational database design 5.2 Normalization using Functional Dependencies 5.3 Normalization using Multi valued Dependencies 5.4 Normalization using Join Dependencies 5.5 Domain – Key normal form [Self Study] Security features provided by access/DB2
Reference Books	1. Database System Concepts – SILBERSCHATZ, KORTH, SUDARSHAN- McGraw- Hill 2. An introduction to Database Systems- C.J.DATE – Addison Wesley 3. Database System: A practical approach to design implementation and management – THOMAS CONNOLLY, CAROLYN BEGG, Pearson Education 4. Access - The Complete Reference – Virginia Andersen – McGraw - Hill 5. Access Database Design & Programming – Steven Roman - O' Reilly 6. Microsoft Access: Bible – Cary N. Prague
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 103: Computer Programming and Programming Methodology

Course Code	103
Course Title	Computer Programming and Programming Methodology
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course introduces the programming skills necessary for computer programming using C language. This course also helps students learn making flowcharts and algorithms.
Course Objective	1.To make students develop logic using flowchart and algorithm 2.To make students develop C programs 3.To make students learn capabilities of a programming language
Pre-requisite	Nil
Course Outcome	After studying the course, students will be able to have logical skills necessary for solving common and complex programming problems. This course also help students learn flowchart and algorithm and their use for developing programs in C programming language.
Course Content	Unit 1. Algorithm & Flowcharting Unit 2. Programming Languages & Structured Programming 2.1 Structured Programming 2.2 Levels of Programming languages 2.3 Compiler/Interpreter 2.4 Program Bugs & Testing 2.4.1 Program Bugs 2.4.2 Preparing Test data 2.4.3 Functional & Structural Testing 2.5 Constants & Variables 2.5.1 Character Set 2.5.2 Constants - needs & definition 2.5.3 Variables - needs & definition 2.5.4 Storage Class 2.5.5 Scope of Variables 2.6 Expressions & Operators 1.6.1 Operators : Assignment, Arithmetic, Increment, Decrement, Relational, Logical, Bitwise, Conditional 2.6.2 Expression 2.6.3 Evaluation & Assignment of Expression 2.6.4 Elementary built-in functions. 2.7 Input & Output Functions 2.8 Jumping, Branching & Looping Statements 2.9 String Built-in functions 2.10 Array 2.11 Structure Union & Enumerated data types Unit 3. User Defined Functions 3.1 Call by value 3.2 Passing Structures & Array 3.3 Recursion Unit 4. Pointer's

	4.1 Basics of Pointers 4.2 Pointer Arithmetic 4.3 Pointer array 4.4 Call by reference in User Defined Functions 4.5 Pointer of function 4.6 Multi-Dimensional arrays using pointers Unit 5. Files and Pre-Processor 5.1 Reading & Writing from a file 5.2 Reading & writing structures 5.3 Random accessing a file 5.4. Pre-processor 5.4.1 # and ## operator 5.4.2 Pre-processor statements 5.4.3 Macro definitions [Self Study] 15.1 Pointers to Functions 15.2 Functions with variable arguments
Reference Books	1. C Language Programming - Byron Gottfried - TMH 2. Pointers in C – Yashwant Kanitkar 3. Programming ANSI C – E Balagurusamy 4. Let US 'C' – Yashwant Kanitkar 5. C Programming Language – Kernighan & Ritchie – TMH 6. 'C' Odyssey (6 Volumes) - Vijay Mukhi - PHI 7. The Complete Reference - C - Herbert Schildt, Tata Mc Graw Hill 8. Structured programming concepts - La Budde - (Mc.Graw HIll) 9. Programming in 'C' – Stephen Kochan - CBS 10. Mastering Turbo C - Kelly & Bootle – BPB 11. Mastering Turbo C - Stan Kelly – BPB
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 104: Enterprise Resource Planning & Financial Management

Course Code	104
Course Title	Enterprise Resource Planning & Financial Management
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course introduces the fundamentals of Enterprise Resource Planning and Financial Management. The course introduces the basics of various ERP modules. Students will also be able to learn financial management with fund flow statement, ratio analysis, cost analysis etc.
Course Objective	1. To make students learn about ERP and its various modules applicable in industry 2. To make students learn about ERP implementation lifecycle 3. To make students learn financial management aspects for managing a business 4. To make students learn financial concepts like fund flow, cost analysis etc.
Pre-requisite	Basics of Computers
Course Outcome	After studying the course, students will be able to determine various processes

	handled under different segments like finance, HR, manufacturing etc. This course also help students learn financial concepts and advanced financial management concepts like fund flow statement, ratio analysis, cost analysis etc.
Course Content	Unit 1. ERP Introduction 1.1. An overview 1.2. Integrated Management Information 1.3. Advantages and disadvantages of ERP 1.4. ERP and Business Processing Re-engineering Unit 2. ERP Implementation Lifecycle 2.1. Pre-evaluation Screening 2.2. Package Evaluation 2.3. Project Planning Phase 2.4. Gap Analysis 2.5. Configuration, Customization, Implementation Team Training, Testing 2.6. Process Definition Documentation 2.7. Issues in implementing ERP packages Unit 3. ERP Modules 3.1. Finance/Accounting 3.1.1. General Ledger 3.1.2. Payables 3.1.3. Cash Management 3.1.4. Fixed Assets 3.1.5. Receivables 3.1.6. Budgeting 3.2. Manufacturing 3.2.1. Bill of Materials 3.2.2. Work Orders 3.2.3. Scheduling 3.2.4. Workflow Management 3.2.5. Quality Control 3.2.6. Cost Management 3.2.7. Manufacturing Process 3.2.8. Manufacturing Projects 3.2.9. Manufacturing Flow 3.2.10. Activity Based Costing 3.2.11. Product Life Cycle Management 3.3. Supply Chain Management 3.3.1. Order to Cash 3.3.2. Inventory 3.3.3. Order Entry 3.3.4. Purchasing 3.3.5. Product Configurator 3.3.6. Supply Chain Planning 3.3.7. Supplier Scheduling 3.3.8. Inspection of Goods 3.3.9. Claim Processing 3.4. Project Management 3.4.1. Costing 3.4.2. Billing 3.4.3. Time & Expense 3.4.4. Performance Units 3.4.5. Activity Management 3.5. Customer Relationship Management

	3.5.1. Generic Architecture of CRM 3.5.2. Key features of CRM 3.5.3. Advantages & Disadvantages of CRM Unit 4 Financial Management 4.1 Meaning and role 4.2 Working Capital Requirements 4.3 Capital Budgeting 4.4 Source of Finance 4.5 Ratio Analysis 4.5.1 Meaning 4.5.2 Advantages 4.5.3 Limitations 4.5.4 Types of ratios and their usefulness. Unit 5 Fund Flow Statement and Costing 5.1 Meaning of the terms - fund, flow and fund, working capital cycle 5.2 Preparation and interpretation of the fund flow statement. 5.3 Costing 5.1 Nature, importance, basic principles and Cost sheet [Self Study] Comparison of different commercial ERP available.
Reference Books	1. Mahadeo Jaiswal, Ganesh Vanapalli: Textbook of Enterprise Resource Planning, McMillan Pub. 2. Enterprise Resource Planning by Alexix Leon , Tata McGraw Hill 3. Enterprise Resource Planning by Ravi Shankar & S.Jaiswal , Galgotia 4. ERP : Making It Happen by Thomas F. Wallace, Michale H. Kremzar, Wiley Publication 5. Van Home, James, C.: Financial Management & Policy, prentice Inc. 6. Shukla & Grewal: Advanced Accounts 7. S.N.Maheshwari: Management Accounting and Financial Control 8. S.N.Maheshwari: Problems & Solutions in Management Accounting & Financial Management 9. S. M. Maheshwari: Cost and Management Accounting, Sultan Chand & Sons Pub.
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 105: Mathematical Foundation Of Computer Science

Course Code	105
Course Title	Mathematical Foundation Of Computer Science
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course explores the area of statistics, linear algebra and graph theory. The course has been introduced for learning these concepts to apply them in various algorithms or protocols in the computer relevant subjects in future semesters.
Course Objective	1. To make students learn interpret statistical data 2. To make students learn various statistical concepts like mean, variance,

	standard deviation, correlation, regression etc. 3. To make students learn linear algebra involving matrix and operations upon matrices 4. To make students learn about graph theory and its concepts
Pre-requisite	Nil
Course Outcome	After studying the course, students will be able to interpret financial data and perform statistical analysis using mean, variance, standard deviation etc. This course also helps students learn apply linear algebra for matrix and its operations. Students will also be able to use graph theory and its applications in forming matrix and trees.
Course Content	1. Statistics 1.1 Concepts of Random Variable 1.2 Probability & Probability Distribution 1.3 Mean & Variance of Probability Distribution 1.4 Statistical data 1.5 Frequency Distributions 1.6 Mean, Variance & Standard Deviation of Data 1.7 Bivariate data 1.8 Concept of Dependent & Independent Variable 1.9 Correlation 1.10 Linear Regression 2. Linear Algebra 2.1 Matrices 2.2 Elementary matrix operations 2.3 Determinants 2.4 Rank of matrix 2.5 Adjoin & Inverse of a matrix 2.6 Matrix representation of simultaneous linear equation 2.7 Solution of simultaneous linear equations using Cramer's Rule 3. Graph Theory 3.1 Definition & Representation of graphs 3.2 Properties of general Graphs 3.3 Matrix representation of Graphs 3.4 Trees and their properties. 4.[Self Study] Problem solving using Excel/SPSS
Reference Books	1. Introduction to Mathematical Statistics - Hogg R V & Craig A L – Tata Mc-Graw Hill 2. An Introduction to the Theory of Statistics - Yule U G & Kendall M G - Chailes Griffin & Co. 3. Fundamental of Mathematical Statistics - Kapoor & Gupta - S Chand & Co. 4. Matrix and Linear Algebra - K B Datta - PHI 5. Linear Algebra - A R Rao & P Bhimashankaram - Tata McGraw Hill 6. Graph Theory - Harry F - Addison Wesley Publication
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 106: Software Lab

Course Code	106

Course Title	Software Lab
Credit	5
Teaching per Week	5 Hrs
Minimum weeks per Semester	15 (Including lab work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course introduces the fundamentals of Database Management System practically using various DBMS's like Access, Mysql and DB2.
Course Objective	1. To make students work practically on Structured Query Language 2. To get students acquainted practically with various DBMSs
Prerequisite	Basic use of Computer
Course Outcome	After studying the course, students will be able to practically work with DBMS and SQL. This course will also help students to execute SQL queries using various databases.
Course Content	Practical based on Paper No: 102 using Microsoft Access, DB2 & MySQL
Reference Books	None
Teaching Methodology	Lab. Work
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 107: Programming Skills – I

Course Code	107
Course Title	Programming Skills – I
Credit	5
Teaching per Week	5 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course introduces the programming skills necessary for computer programming using C language practically. This course also helps students learn making flowchart and algorithm.
Course Objective	1.To make students develop logic using flowchart and algorithm 2.To make students develop C programs practically 3.To make students learn capabilities of a programming language practically
Prerequisite	Nil
Course Outcome	After studying the course, students will be able to develop logic necessary for solving common and complex programming problems. This course also help students learn flowchart and algorithm and their use for developing programs in C programming language.
Course Content	Practical based on Paper No: 103 using C Language
Reference Books	None
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

MCA 2nd Semester

Course: 201: Object Oriented Programming

Course Code	201
Course Title	Object Oriented Programming
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course introduces the concepts of object oriented programming and skills necessary for developing programs in C++.
Course Objective	1. To make students understand concepts of object oriented paradigm 2. To make students develop C++ programs 3. To make students learn capabilities of an object programming language
Pre-requisite	Nil
Course Outcome	After studying the course, students will be able to develop logic necessary for solving common and complex programming problems using object oriented paradigm.
Course Content	Unit 1 Introduction to Object Oriented Paradigm 1.1 Overview of OMT 1.2 Types of other programming paradigm and O.O. paradigm 1.3 Introduction of O.O. analysis and design methods Unit 2. Object Modeling & Design 2.1 Object & Classes 2.2 Links and Associations 2.3 Classification of Object 2.4 Aggregation & Generalization 2.5 UML: Introduction & Overview 2.5.1 Use-cases and tasks 2.5.2 Event Charts 2.5.3 State Charts 2.5.4 Finding use-cases 2.5.5 Connecting use-case and class views 2.5.6 UML notation review Unit 3. Procedure Oriented Programming Vs. Object Oriented Programming 3.1 Structure & classes 3.2 Encapsulation & Data Hiding 3.3 Constructors 3.4 Friend Functions 3.5 Inline Functions 3.6 Dynamic Object Creation & Destruction 3.7 Destructors Unit 4. Object Oriented Properties 4.1 Introduction to Object Oriented Properties 4.2 Abstraction 4.3 Polymorphism 4.3.1 Operator Overloading 4.3.2 Function Overloading & Type Conversions 4.4 Inheritance 4.4.1 Types of Inheritance 4.4.2 Constructor & Destructor calls during Inheritance

	4.5 Dynamic Polymorphism 4.5.1 Overriding 4.5.2 Virtual Functions 4.5.3 Abstract Class Unit 5. Data Files and Exception Handling 5.1 Streams 5.2 File Types and Modes 5.3 File Pointers & their manipulations 5.4 Sequential Input & Output operations 5.5 Random access 5.6 Error handling during File operations 5.7 Exception Handling Self Study [Generic Programming] Template Classes & Function
Reference Books	1. The C++ Programming Language, Stroustrup, Addison Wesley 2. The Complete Reference C++, Schildt, Tata McGraw Hill 3. OOP in Tourbo C++, Robert Lafore, Galgotia Publication 4. C++ Primer, Lippman, Addition Wesley 5. Object Oriented Programming with ANSI and Turbo C++, Kamthane, Pearson Education 6. Thinking in C++, Bruce Eckel, Pearson 7. Object Oriented Modelling & Design, Rumbaugh, PHI 8. Object Oriented Analysis & Design with Application, Grady Booch, LPE 9. Standard C++ with Object Oriented Programming, Paul S. Wang, Thomson 10. Object Oriented Design, Peter Coad, Prentice Hall 11. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modelling Language User Guide, Pearson Education. 12. Programming with ANSI C++, Bhushan Trivedi, Oxford University Press
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 202: Data Structures

Course Code	202
Course Title	Data Structures
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course introduces the various data structures and algorithms involving these data structures and their logical implementation. Students also will be able to understand complex data structures like trees and their use in various applications
Course Objective	1. To learn fundamental data structures like arrays, stacks, lists. 2. To learn complex data structures like trees. 3. To learn and compare various sorting techniques. 4. To learn analysis of algorithms
Pre-requisite	C programming Language
Course Outcome	After studying the course, students will be able to use data structures and their application in sorting, searching and comparison of algorithms. Students will also learn analysis of the algorithms.

Course Content	Unit 1. Non-Primitive Data structures. 1.1 Arrays - its storage structures & operations 1.2 Stacks - operations and its applications in Recursion, Polish expressions etc. 1.3 Queues - Types of queues, operations and its applications. 1.4 Linked lists - Types of linked list, operations and its applications. 1.5 Trees - Concept and Definitions, Operations, linked & threaded storage representation of Binary Trees. 1.6 Applications of Trees - The manipulation of Arithmetic expressions, Symbol-table construction, Syntax Analysis etc. Unit 2. Analysis of Algorithms 2.1 Asymptotic: Big-O and Theta Unit 3. Basic techniques & example algorithms for 3.1 Divide & Conquer method 3.2 Greedy method 3.3 Backtracking 3.4 Branch & Bound Unit 4. Searching and Sorting 4.1 Sequential, Binary 4.2 Search Trees:- Height, Balanced tree, 2-3, tree, red-black trees weight-balanced trees 4.3 Sorting 4.1 Internal sorting - Insertion, Selection, Quick, 2-way merge and Heap 4.2 External sorting - k-way merging, Balanced merge and poly phase merge Unit 5. Hashing 5.1 Hash Tables 5.2 Hash functions 5.2.1 Division method 5.2.2 Multiplication method [Self Study] Graphs – Creation and Traversal
Reference Books	1. An Introduction to Data Structures with applications - Trembley – McGraw Hill 2. Theory and Problems of Data Structure – Lipschutz Semour – McGraw-Hill 3. Algorithms + Data Structure Programs - Wirth, Niclaus - PHI. 4. Fundamentals of Data Structures,Horwitz, E. and Sahni S. - Computer Science Press. 5. The Art of Computer Programming, Vols. 1-2, Knuth D. - Addison Wesley. 6. Data Structures and Algorithms - Aho A.V., Hopcroft and Ullman - Addison Wesley 7. Data Structure & "C" Programming - Vanwyte C J - Addison Wesley. 8. Data Structures, Algorithms And Object Oriented Programming – Tata McGraw Hill edition Geogory L. Heileman. 9. Data Structures and the Standard Template Library - William J. Collins, Tata McGraw Hill edition. 10. Programming with C++ and Data Structures - Maria Litvin & Gary Litvin, Vikas Publishing House Pvt. ltd. 11. Data Structures using C & C++ - Y. Langsam Moshe J. Angensterin & A.M. Terenbanm

	12. Data Structures and Algorithms in C++ - Adam Drozdek, Thomson Learning 13. Data Structures & Program Design in C - Robert Kruse, C.L. Tondo, Brnce leing PHI Pvt Ltd.
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 203: Relational Data Base Management Systems

Course Code	203
Course Title	Relational Data Base Management Systems
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course introduces the fundamentals of Relational Database Management System. The course includes the advanced concepts of RDBMS like and makes students acquainted with advanced features of database like system architectures, crash recovery, security and integrity, and concurrency control.
Course Objective	1. To make students understand fundamentals of RDBMS 2. To get students acquainted with advanced features of RDBMS
Pre-requisite	Database management system, Structured Query Language
Course Outcome	After studying the course, students will be able to understand the internals of DBMS. This course will also help students to learn database, its architecture, security and concurrency
Course Content	Unit 1. Storage and File Structure. 1.1 Overview of Physical Storage Media 1.2 Magnetic Disks 1.3 RAID 1.4 File Organization 1.5 Organization of records in File 1.6 Data – Dictionary Unit 2. Indexing and Hashing 2.1 Ordered Indices 2.2 B+ Tree Index Files 2.3 B- Tree Index Files 2.4 Static Hashing 2.5 Dynamic Hashing 2.6 Comparison of Ordered Indexing and Hashing 2.7 Index Definition in SQL 2.8 Multiple – Key Access Unit 3. Database System Architectures and Crash Recovery 3.1 Centralized Systems 3.2 Client – Server Systems 3.3 Parallel Systems 3.4 Distributed Systems 3.5 Network Types 3.6 Crash Recovery 3.6.1 Failure classification 3.6.2 The storage hierarchy 3.6.3 Transaction model 3.6.4 Log-based recovery

	3.6.5 Buffer management 3.6.6 Checkpoints 3.6.7 Shadow Paging Unit 4. Security and Integrity 4.1 Security and integrity violations 4.2 Authorization and views 4.3 Security specification in SQL 4.4 Encryption Unit 5. Query Processing and Concurrency Control 6.1 Query interpretation 6.2 Equivalence of expressions 6.3 Estimation of Query-processing cost 6.4 Join Strategies 6.5 Structure of the query optimizer 6.6. Concurrency Control 6.6.1 Schedules 6.6.2 Testing for serializability 6.6.3 Lock-based protocols 6.6.4 Timestamp-based protocols 6.6.5 Validation techniques [Self Study] A case study on Distributed Database System Architecture.
Reference Books	1. Database System Concepts - Henry F. Korth & AbrahamSilberschatz - TMH 2. Principles of Database Systems - Jeffery Ullman - Galgotia Publication 3. An introduction to Database Systems - C.J.Date - Addison- Wesley 4. Introduction to Database Management - Navin Prakash – TMH 5. Introduction to Database System - Bipin C. Desai – Galgotia 6. Manual of RDBMS.
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 204: Optimization Techniques

Course Code	204
Course Title	Optimization Techniques
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course aims towards learning of linear programming. The course also teaches students about job sequencing, Inventory problem and network analysis using CPM, PERT
Course Objective	1. To make students learn about linear programming models 2. To make students learn transportation and assignment problem of OT 3. To make students lean job sequencing, inventory problem and network analysis using CPM and PERT
Pre-requisite	Basic mathematics
Course Outcome	After studying the course, students will be able to solve real time practical applications using linear programming and its models. The course also makes students learn about transportation problem, assignment problem, job

	sequencing, inventory problem, and network analysis using CPM, PERT
Course Content	Unit 1. Linear Programming 1.1 Formulation of L.P.P. 1.2 Solution Methods 1.2.1 Graphical Method 1.2.2 Simplex Method 1.2.3 Two Phase Method 1.2.4 Big-M Method Unit 2. Special cases of L.P.P. 2.1 Transportation Problem 2.2 Assignment Problem Unit 3. Job Sequencing 3.1 Processing n jobs through 2 machines 3.2 Processing n jobs through 3 machines 3.3 Processing 2 jobs through m machines 3.4 Processing n jobs through m machines Unit 4. Inventory Problem 4.1 Introduction to Inventory 4.2 Deterministic Inventory models 4.3 Dynamic Inventory models Unit 5. Network Analysis 5.1 PERT 5.2 CPM [Self Study] Practical of PERT CPM
Reference Books	1. Hiller F.S. & Liberman G.J.: Introduction to OperationsResearch 2nd Edn.:- Holand Day Inc. London, 1974 2. Tara H.A.: Operation Research, 3rd Edn.- McMillan Publishing Company, 1982 3. Beightler C.S. & Phillips D.T.: Foundations of Optimization,- Prentice Hall, 1979 4. McMillan claude Jr.: Mathematical Programming, 2nd Edn.- Wiley Series, 1979 5. Gillett B.G.: Introduction to Operation Research - A Computer oriented Algorithmic approach- McGrow Hill Book Comp., 1976 6. N.S. Kambo: Mathematical Programming Techniques
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 205: Computer Network

Course Code	205
Course Title	Computer Network
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course aims towards learning fundamentals of computer network. The

	course teaches students about the various network technologies and popular network protocols
Course Objective	1. To make students learn about computer network fundamentals 2. To make students familiar with services offered at each layer of the network protocol stack 3. To make students learn various protocols at data link layer, network layer, and transport layer of network.
Pre-requisite	Nil
Course Outcome	After studying the course, students will be able to understand network fundamentals. This course will also help students to learn fundamental network protocols at data link layer, network layer and transport layer. Security concepts, digital certificate, Public key Infrastructure, and similar security schemes will be explored by the students.
Course Content	Unit 1. Introduction to Data Communication 1.1 Introduction to networks, Internet and its application 1.2 Network Structure 1.3 Network Architecture 1.4 The OSI Reference model & services 1.5 The TCP/IP Reference model and Comparison with OSI Model 1.6 Concepts of data transmission 1.6.1 Guided and unguided Transmission media. PSTN 1.7 Multiplexing & switching techniques 1.8 ISDN (Integrated Service Digital Network) Unit 2. Data Link Layer 2.1 MAC Sub layer 2.1.1 Multiple Access Protocols 2.1.2 Ethernet 2.1.3 LAN protocols & IEEE standards for LAN 2.1.4 Fibre Optic & Satellite networks 2.2 Data Link Layer protocols 2.3 Error detection & correction Unit 3. Upper Layers 3.1 Network 3.1.1 Routing Algorithms 3.1.2 Congestion Control Algorithm 3.1.3 Internetworking 3.2 Transport Layer 3.2.1 Connection Management 3.3 Concepts of Session Layer Unit 4. The Presentation Layer 4.1 Data Compression Technique 4.2 Cryptography 4.3 Symmetric Key Algorithms 4.4 Public – Key Algorithms & management of Public Keys 4.5 Digital Signatures and Communications security Unit 5. The Application Layer 5.1 Electronic Mail 5.2 Virtual Terminals 5.3 General Purpose Applications [Self Study] Virtual LAN
Reference Books	1. Networking Complete- 1st Edition 2002, BPB Publication (Text Book)

	2. Data Communication and Networking: Forouzan, TMH 3. Computer Networks - A. S. Tanenbaum - Prentice-Hall 4. Computer Networks and Distributed Processing - Martin J. - Pretice-Hall 5. Local Area Networks: An Introduction - Stalling, William - Mc-Millan Publishing Co. 6. Computer Networks: Protocols, Standards and Interfaces - Black – Prentice-Hall 7. Data Networks: Concepts Theory and Practices - Black - PHI 8. N/W Architecture - Comer - Prentice-Hall
Teaching Methodology	Class Work, Discussion, Self Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 206: Programming Skills – II

Course Code	206
Course Title	Programming Skill – II
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including lab work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course helps students practically implement the concepts of object oriented programming using C++.
Course Objective	1. To make students practically learn concepts of object oriented paradigm 2. To make students develop and code C++ programs.
Pre-requisite	Nil
Course Outcome	After studying the course, students will be able to practically solve common and complex programming problems using object oriented paradigm. This course also helps students learn practical implementation of data files and operations upon them using object oriented approach.
Course Content	Practical based on paper no: 201 (C++)
Reference Books	None
Teaching Methodology	Lab. Work
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 207: Programming Skills – III

Course Code	207
Course Title	Programming Skill – III
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including lab work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course introduces the various data structures and algorithms involving these data structures and their practical implementation using C programming language. Students also will be able to understand and write C programs using complex data structures like trees.
Course Objective	1. To practically learn implementation of fundamental data structures like arrays, stacks, lists. 2. To learn implementing complex data structures like trees in C programs. 3. To learn and compare various sorting techniques practically.

	4. To learn analysis of algorithms practically.
Pre-requisite	C programming Language
Course Outcome	After studying the course, students will be able to use data structures and their application in sorting, searching and comparison of algorithms. Students will also learn analysis of the algorithms.
Course Content	Practical based on paper no: 202 (Data Structures)
Reference Books	None
Teaching Methodology	Lab. Work
Evaluation Method	30% Internal assessment 70% External Assessment

Course: 208: Programming Skills – I V

Course Code	208
Course Title	Programming Skill – IV
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including lab work, examination, preparation, holidays etc.)
Review / Revision	June 2015
Purpose of Course	This course aims towards learning fundamentals of computer network practically. The course teaches students about the various network technologies and popular network protocols and their practical implementation using C programming language.
Course Objective	1. To make students practically learn about computer network fundamentals 2. To make students learn various protocols at data link layer, network layer, and transport layer of network and simulate them practically using C programming language.
Pre-requisite	Programming in C Language
Course Outcome	After studying the course, students will be able to understand network fundamentals practically. This course will also help students to practically learn fundamental network protocols at data link layer, network layer and transport layer.
Course Content	Practical based on paper no: 205 (Computer Network)
Reference Books	None
Teaching Methodology	Lab. Work
Evaluation Method	30% Internal assessment 70% External Assessment