Solapur University, Solapur

M.Sc. (Computer Science)

Syllabus (Semester – I and II)

(Credit System)

With Effect from June 2011

Solapur University, Solapur
M.Sc. (Computer Science)

1. Introduction: A broad introduction of computer science is provided, including the key technologies and skills needed for employment. Student can explore his / her personal interests through a variety of optional modules. Advanced intellectual, teamwork, communication and other transferable skills are developed. These students are expected to lead new generation of computer scientist. The students would be true knowledge workers prestigious to the Nation.

2. Eligibility : The candidate passing any of the under graduate degree, namely, B.Sc.(Computer Science), B.C.S., B.Sc. (Computer Technology), B.Sc. (Mathematics), B.Sc.(Statistics), B.Sc. (Electronics) will be eligible for admission to M.Sc. Computer Science.

3. Intake capacity of Students : 20 / 30

4. Admission / Selection Procedure : A student shall be held eligible for admission to the M. Sc. (Computer Science) course provided he / she has passed the B.Sc. examination in the subjects mentioned in Eligibility. and has passed the entrance examination conducted by the University. The students with B.Sc. from other universities shall be eligible if they qualify through entrance examination and they score minimum 55 percent B+ marks in the subject at the B.Sc.examination. While preparing the merit list for M. Sc. (Computer Science) admission, the performance at B.Sc.III and the performance at the entrance examination will be given equal weightage (50:50)

5. Duration of the Course : The M.Sc. is offered on full time basis, the course is of two years duration named as M.Sc. (Computer Science), each year is divided into two semesters for the convenience of teaching and examination . In each semester there will be teaching for 14 weeks followed by end of semester examination.

6. Fees Structure :- The tuition fees or laboratory fees and other fees have to be paid at the beginning of per year. At present a student has to pay tuition fees Rs.4000 /- per year, laboratory fee Rs.6000/- per year and laboratory deposit of Rs.500/- together with other fees. These fees may be revised from time to time. The fees once paid will not be refunded.

7. Structure of the Syllabus :

M. Sc. program in Computer Science consists of 100 credits. Credits of a course are specified against the title of the course.

A Four Semester M.Sc. Computer Science Course

Semester	No. of Papers/ Practicals / Seminar	Marks	Credits
Semester I			
• Theory Papers	04	400	16
• Practical Papers	01	100	04
• Project	01	100	04
• Seminar/Tutorial/Home Assignment /Field Tour/ Industrial Visit	01	25	01
Semester II			
• Theory Papers	04	400	16
• Practical Papers	01	100	04
• Project	01	100	04
• Seminar/Tutorial/Home Assignment /Field Tour/ Industrial Visit	01	25	01
Semester III			
• Theory Papers	04	400	16
• Practical Papers	01	100	04
• Project	01	100	04
• Seminar/Tutorial/Home Assignment /Field Tour/ Industrial Visit	01	25	01
Semester IV			
• Theory Papers	04	400	16
• Practical Papers	01	100	04
• Project	01	100	04
• Seminar/Tutorial/Home Assignment /Field Tour/ Industrial Visit	01	25	01
Total marks and credits for M.Sc. Course		**2500**	**100**

M.Sc. (Computer Science) Part – I Semester-I

Paper Code	Title of the Paper	Contact hours/week	Distribution of Marks for Examination			Credits
			Internal	University	Total	
CS-101	Object Oriented Programming using C++	04	30	70	100	04
CS-102	Numerical Analysis	04	30	70	100	04
CS-103	Software Engineering	04	30	70	100	04
CS-104	Data Structures	04	30	70	100	04
CS-105	Project - I	02	30	70	100	04
CS-106	Practical - I	12	30	70	100	04
	Seminar	02	25	--	25	01
Total		**32**	**205**	**420**	**625**	**25**

M.Sc. (Computer Science) Part – I Semester-II

Paper Code	Title of the Paper	Contact hours/week	Distribution of Marks for Examination			Credits
			Internal	University	Total	
CS-201	Operations Research	04	30	70	100	04
CS-202	Computer Communication Network	04	30	70	100	04
CS-203	UML	04	30	70	100	04
CS-204	DBMS	04	30	70	100	04
CS-205	Project - II	02	30	70	100	04
CS-206	Practical – II (VB6.0 & DBMS)	12	30	70	100	04
	Seminar	02	25	--	25	01
Total		**32**	**205**	**420**	**625**	**25**

8. Passing Standard : Passing standard is same as that of other M.Sc. courses in the Solapur University. The candidate has to appear for internal evaluation of 30 marks and external evaluation (university exam) for 70 marks for each paper / practical / project. In case of theory papers internal examination/s will be conducted by the school / department. The nature of internal evaluation of practical and project will be decided by

the respective schools / departments. The internal evaluation is a process of continuous assessment.

A student who failed in Term End examination (theory) & passed in Internal assessment of a paper (subject) shall be given FC (Failed in Term End Exam.) Grade. Such student will have to appear for Term End examination only. A student who fails in Internal assessment and passed in Term End examination (Theory) shall be given FR (Failed in Internal Assessment) Grade. Such student will have to appear for Term End examination as well as internal assessment.

In case of year down candidates from the mark scheme the candidates shall appear for the same 70 marks paper of the external examination and his performance shall be scaled to 100 marks.

9. Nature of theory question paper

1) Duration of each theory paper is 3 hours.

2) Each paper contains 7 questions each carrying 14 marks.

3) Students have to attempt five questions.

4) Question No.1 is compulsory and contains 14 objective type sub-questions each carrying 1 mark.

5) Question No.2 is compulsory and contains 3 short answer / short note type sub-questions each carrying 5 or 4 marks.

6) Students have to attempt any 03 questions from Question No. 3 to Question No. 7.

7) Question No. 3 to Question No. 7 contains 2 sub-questions.

M.Sc. (Computer Science) – Part – I
SEMESTER I

CS-101 : Object Oriented Programming using C++

1. **Algorithm Development** : Problem definition, Writing step by step procedure, representation in terms of Flow chart,, Tracing, Testing [2]
2. **Overview Of C++ :** Object Oriented Programming, Introducing C++ Classes, Concepts of Object Oriented Programming, C++ as a superset of C,
   New style comments, main function in C++, meaning of empty argument list, function prototyping, default arguments and argument matching, User defined data types: enumerated types, use of tag names, anonymous unions, scope of tag names [4]
3. **Classes & Objects** :Classes, Structure & Classes, Union & Classes, Inline Function, Scope Resolution operator, Static Class Members: Static Data Member, Static Member Function, Passing Objects to Function, Returning Objects, Object Assignment. Friend Function, Friend Classes [4]
4. **Array, Pointers References & The Dynamic Allocation Operators**: Array of Objects, Pointers to Object, Type Checking C++ Pointers, The This Pointer, Pointer to Derived Types, Pointer to Class Members, References: Reference Parameter, call by reference and return by reference Passing References to Objects, Returning Reference, Independent Reference, C++'s Dynamic Allocation Operators, Initializing Allocated Memory, Allocating Array, Allocating Objects. [5]
5. **Constructor & Destructor**: Introduction, Constructor, access specifiers for constructors, and instantiation, Parameterized Constructor, Multiple Constructor in A Class, Constructor with Default Argument, Copy Constructor, Destructor. [4]
6. **Overloading as polymorphism** : Function & Operator Overloading : Function Overloading, Overloading Constructor Function Finding the Address of an Overloaded Function, Operator Overloading: Creating A Member Operator Function, Creating Prefix & Postfix Forms of the Increment & Decrement Operation, Overloading The Shorthand Operation (I.E. +=,-= Etc), Operator Overloading Restrictions, Operator Overloading Using Friend Function, Overloading New & Delete, Overloading Some Special Operators, Overloading [ ], ( ), -, Comma Operator [6]
7. **Inheritance :** Base Class Access Control, Inheritance & Protected Members, Protected Base Class Inheritance, Inheriting Multiple Base Classes, Constructors, Destructors & Inheritance, When Constructor & Destructor Function are Executed, Passing Parameters to Base Class Constructors, Granting Access, Virtual Base Classes . [6]
8. **Virtual Functions & Polymorphism** : Virtual Function, Pure Virtual Functions, Early Vs. Late Binding, Templates and Exception Handling. [4]
9. **Templates:** Reason for templates compactness and flexibility, function template examples explicit specialization, class templates, out of class definition of member functions [2]

10. **The C++ I/O System Basics** : C++ Streams, The Basic Stream Classes C++ Predefined Streams, Formatted I/O: Formatting Using The Ios Members, Setting The Formal Flags, Clearing Format Flags, An Overloaded Form Of Setf ( ), Using Width() Precision() and Fill(), Using Manipulators to Format I/O, Creating Your own Manipulators. [4]
11. **Working with files** : Introduction, Classes for file stream operations, Opening and Closing file, Open(): File Modes, File pointers and their Manipulations, Sequential Input and Output Operations, Updating a File: Random Access , Error Handling During File Operations [4]

REFERENCE BOOKS:

1) C++ THE COMPLETE REFERENCE BY *HERBERT SEHILDT - TMH*
2) C++ BY *BALGURUSWAMI – TATA MCGRAW HILLS*
3) C++ BY M. KUMAR, TATA MCGRAW

CS-102 Numerical Analysis

1. Errors in numerical calculations and solution of algebraic and transcendental equations: [12]

Numbers and their accuracy, Mathematical preliminaries, Errors & their computation: Absolute, relative & percentage errors, A general error formula, Error in series approximation, The iteration method & it's rate of convergence, The method of false position & its rate of convergence, Secant method & its rate of convergence, Newton Raphson method and its rate of convergence.

2**. Interppolation and Numerical Differentiation**. [12]

Errors in polynomial interpolation, Finite Differences: Forward, Backward & Central Differences, Symbolic relations & separation of symbols, Newton's Formula for interpolation, Lagrange's interpolation formula and error in Lagrange's interpolation formuls, Divided differences & their properties, Newton's general interpolation formula.

3**. Numerical solutions of system of linear equations & Eigen Values**. [12]

Gaussian elimination method, Method of factorization (LU decomposition), Iterative Method: Gauss Seidal Method, Eigen value problem: Householder's method, Eigen value of symmetric tridiagonal matrix, Power method for largest Eigen value

4. **Numerical Intergration and Solutions of ordinary differential equations** [12]

Numerical Integration: Trpezoidal rule Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule, Errors in the above methods, Solution of differential equation by Taylor's series: Euler's method and Euler's modified method

Recommended Text Book :

1) S. S. Sastry Introductory Methods of Numerical Analysis, 3^{rd} edition, Prentice Hall of India, 2001

2) M. K. Jain, S. R. K. Iyengar, S. R. Iyenger, R. K. Jain, Numerical Methods for scientific and Engineering computation, 3^{rd} edition, wiley Eastern Ltd., 1992

Reference Book :

1) Atkinson K. E., An Introduction to Numerical Analysis, John Wiley and Sons, N. Y., 1978.

2) Froberg C. E., Introduction to Numerical Analysis, Johns Hopkins University Press, Baltimore, 1950.

3) CS-103: Software Engineering

1. Introduction: Product and Process: Evolving role of software, software characteristic and components, crisis, myths, software engineering – a layered technology, software process, linear sequential model, prototyping model, RAD model, evolutionary software process model. [8]

2. Software Process And Project Metrics: Measures, metric indicators, metric in process and the project domains, software measurement, metrics for software quality, software quality assurance. [4]

3. Analysis Concepts And Principles: Requirement analysis, communication techniques, analysis principles, software prototyping & Specification. [6]

4. Analysis Modeling: Elements of the analysis model, data modeling, functional modeling, behavioral modeling, the mechanics of structured analysis, data dictionary, other classical analysis methods. [6]

5. Design Concepts & Principles: Software Design and software Engineering design process, Design principles, Design concepts, Design methods-Data design, Architectural design and process, Transform and Transaction mappings, Design post processing, Architectural design optimization, Interface design, Procedural design. [8]

6. Software Testing Methods: Fundamentals, Test case design, White box testing, basis path testing, control structure testing, black box testing, Software testing strategies. [6]

7. Object Oriented Software Engineering: Object oriented concepts, Identifying the elements of an object model, Management of object-oriented software projects, Object-oriented analysis, design and testing. [6]

REFERENCES:

1. Roger S. Pressman, Software Engineering **,** McGraw Hill(1997).
2. Shooman, Software Engineering, McGraw Hill(1987).
3. I. Sommerville, Software Engineering, International Computer Science Series(1985).
4. Booch, Object-Oriented Design & Analysis, Benjamin / Commings.
5. Rambaugh J., Bluha M., Premerlani W., Eddly Fand Lorenen W., Object-Oriented Modeling and Design, PHI(1991).
6. Ghezzi, Etal; Fundamentals of Software Engineering, PHI.

CS-104 : Data Structures

1. **Fundamental notions** : Primitives and composite data types , choice of data structure and complexity of an algorithms. [4]

2. **Arrays :** Single and Multidimensional Arrays, sparse matrices. [4]

3. **Linked List :** Processing linked list, Circularly linked list, Doubly linked list, Multilinked lists, String and characters manipulation using arrays and linked list. [8]
4. **Queues** : Processing the queues, Linked list implementation, Dequeues, Priority queues and their applications. [4]

5. **Stacks** : Processing the stacks, Linked list implementation, Application of Stacks for expression solving, Non recursive implementation of recursive algorithms. [4]

6. **Trees** : Representation of hierarchical relationships, Tree processing, Binary trees, linked list implementation, traversal algorithms, Graph theoric solutions and tree traversals, Binary trees, Threaded binary trees, Height balanced trees, General Trees,. [8]

7. **Design and analysis of algorithm for the implementation** : Greedy methods, Dynamic programming, Backtracking, Branch and bound [6]

8. **Sorting and searching** : Various sorts, searching algorithms and their complexities, . Binary tree indexing, B-tree indexing, Hash indexing [6]

Reference books:

1) Aho, Hop craft and Ulman, Data structures and algorithms (Addision - Wesley)
2) Bhagat Sing and Nap, Introduction to data structures (TMH-85).
3) Kernighan B. and Ritchie D., The C Programming Language (HI-88)
4) Tremble & Sorenson, Introduction to Data Structures with application (TMC-84).
5) Weiderberg : Data and file structures

CS-105 : Project –I

Project work

CS-106 : Practical -I

Minimum 20 Practical Assignments based on papersCS-101, CS-102 and CS-104

M.Sc. (Computer Science) – Part – I
SEMESTER II

CS-201 : Operations Research

1. Convex Sets and Functions: Convex sets, supporting and separating hyperplanes, convex polyhedra and polytope, extreme points, convex functions. [**5]**

2. Linear Programming Problem (LPP): Introduction to linear programming problems, Graphical solution to LPP, Standard LPP (SLPP), basic solution and basic feasible solution to SLPP. Methods for solving LPP: Simplex Algorithm, Two-phase simplex method, Big M method. [**15]**

3. Duality in LPP: Concept of duality, Theorems related to duality, complementary slackness property and development of dual simplex algorithm. **[5]**

4. Integer Linear Programming Problem (ILPP): The concept of cutting plane, Gomory's method of cutting plane for all ILPP and mixed ILPP, Branch and Bound method (Algorithm only). [**9]**

5. Quadratic Programming Problem (QPP): Definition of QPP, Kuhn-Tucker conditions, Algorithms for solving QPP: Wolfe's and Beale's algorithm. **[8]**

6. Theory of Games: Two person zero sum games, Minimax and Maxmin principles, Saddle point, mixed strategies; rules of dominance, solution of 2 x 2 game by Algebraic method, Graphical method, Reduction of game problem as LPP, Minimax and Maxmin theorem (without proof). [**8]**

Reference Books:

1) Hadley G. (1969): Linear Programming, Addision Wesley.
2) Taha H. A. (1971): Operations Research an Introduction, Macmillan N. Y.
3) Kanti Swaroop, Gupta and Manmohan (1985): Operations Research, Sultan Chand & Co.
4) Sharma J. K. (2003): Operations Research Theory and Applications, 2nd Ed. Macmillan India ltd.
5) Sharma J. K. (1986): Mathematical Models Operations Research, Macgraw Hill.

CS-202 : Computer Communication Network

1. Introduction [8]

Uses of Computer networks; Business Applications, Home Applications, Mobile Users, Social Issues, Network Hardware; Local Area Networks, Metropolitan Networks, Wide Area Networks, Wireless Networks, Home Networks, Internetworks; Network Software, Protocol Hierarchies, Design Issues for the Layers, Connection-Oriented and Connectionless Service Primitives, The Relationship of Services to Protocols; Example of Networks; The Internet, The ARPANET, NSFNET, Internet usage Architecture of the internet.

2. Network Layer [14]

Network Layer Design issues; Store and Forward packet Switching, Services Provided to the Transport Layer, implementation of Connectionless Service, Implementation of Connection-oriented Services, Comparison of Virtual Circuit and Datagram subnets; Routing algorithms; The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link state Routing, Hierarchical Routing, Broadcast Routing, Routing for Mobile Hosts, Congestion Control Algorithms; General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnet, Load Shedding, Jitter Control; Quality of Service; Requirements, Techniques for Achieving Good Quality of Service, Integrates Services, Differentiates Services; Internetworking; Differences in Networks, Network Connection. Concatenated Virtual Circuits, Connectionless Internetworking; Tunneling; Internetwork Routing; Fragmentation; The Network Layer in the Internet; The IP Protocol, IP Addresses, Internet Control Protocols, The Interior Gateway Routing Protocol; OSPF, The Exterior Gateway Routing Protocol; BGP; Internet Multicasting; Mobile IP; IPV6.

3. The Transport Layer [8]

The Transport Service : Services Provided to the Upper Layers, Transport Service Primitives, Berkeley Sockets; Elements of Transport Protocols; Addressing, Connection Establishment, Connection Release Flow Control and Buffering, Multiplexing, Crash Recovery; The Internet Transport Protocol; The Internet Transport, Introduction to UDP, Remote Procedure Call, The Real-Time Transport Protocol; The Internet Transport Protocols – TCP Connection Establishment, TCP Connection Release, Modeling TCP Connection Management TCP Transmission Policy, TCP Congestion Control, TCP Timer Management, Wireless TCP and UDP, Transactional TCP.

4. The Application Layer [8]

DNS – The Domain Name System: The DNS Name Space, Resource Records, Name Servers; Electronic Mail; Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web; Architectural Overview, Static Web Documents, Dynamic Web Documents, HTTP, Performance Enhancements, The Wireless Web.

5. Network Security **[6]**

Cryptography; Introduction to Cryptography, Substitution Ciphers, Transposition Ciphers, One-Time Pads, Two Fundamental Cryptographic Principles; Symmetric Key Algorithms; DES-The Data Encryption Standars, AES – The Advances Encryption Standard; Public Key algorithms; RSA, Other Public Key algorithms; Digital Signatures, Symmetric-Key Signature, Public key Signature, Message Digests.

Reference Books :

1. Andrew S. Tanenbaum, Computer Networks, 4 th Edition, Pearson Education, Asia, 2002.
2. Alberti Leon – Garcia and Indra Wadjaja, Communication Networks-Fundamental Concepts and Key Architectures, Tata McGraw Hill, Edition-2000.
3. Behrouz A Forouzan, Data Communications and Networking, Tata McGraw Hill, Second Edition, 2001.

CS-203 : UML

1. Object Oriented Design and Modelling: Object Oriented Fundamentals, Objects and object classes, object oriented design process, importance of modelling, principles of modelling, object oriented modelling. [6]

2. Introduction to UML: Conceptual model of UML, building blocks of UML, Mechanisms in UML, architecture, software development life cycle. [6]

3. Basic Structural Modelling : Classes, relationships, common mechanisms, class and object diagrams. [6]

4.Advanced structural Modelling : Advanced classes, advanced relationships, Interfaces types and roles, packages, instances and object diagrams. [6]

5. Collaboration Diagrams and Sequence Diagrams: Terms, concepts and depicting a message in collaboration diagrams. Terms and concepts in sequence diagrams. Difference between collaboration and sequence. diagram. Depicting synchronous messages with/without priority call back mechanism. [8]

6. Basic behavioral modeling : Interactions,use cases, Use Case Diagrams, Interaction Diagrams and activity diagrams. [4]

7. Advanced behavioral modelling: Events and signals, state machines, process and threads, time and space, state chart diagrams. [4]

8. Architectural Modelling: Terms, Concepts, examples, Modelling techniques for component diagrams and deployment diagrams. [4]

References :

1. Grandy Booch,James Rumbough,Ivar Jacobson.‘ The Unified Modelling Language User Guide..Pearson Edutaion 2002.
2. Ian Sommerville,‘ Software Engineering Sixth Edition ’ 2003..
3. Meilir Page Jones,‘ Fundamentals of Object Oriented Design in UML ’, Addison Wesley,2000

CS-204 : DBMS

1. **Introduction to Database Systems :** Database – Definition, Limitations of traditional file processing systems, Advantages of DBMS, Users of DBMS [2]
2. **Database Architecture and Environment :** Components of DBMS, Architecture, Physical, logical and view, DDL, DML, DCL, schemas, life cycle of Database System Development, Functions of DBMS. [4]
3. **Conceptual Database Modelling :** Data Model – Concept, types of data models, ER model, concepts of entity, entity set, attributes, domains, existence dependency, Keys : candidate, primary, composite, strong and weak entities, cardinality, specialization, generalization, aggregation, Relational Algebra, Relational Calculus [6]
4. **Relational Database Systems :** Characteristics, relation, attribute, tuple, domain, null, Normalization, Functional Dependencies, Multivalued Dependencies, 1NF, 2NF, 3NF, 4NF, 5NF Boyce codd's normal form [6]
5. **SQL and PL/SQL:** DDL, DML, DCL, Select : From, Where, Order by, Group by, Having, Intersect, Union, Distinct, Between, In, Between, Different types of functions, Delete, Update, Insert, Nested queries, joins, create, alter and drop, constrains, index, views, Triggers, Grant, Revoke, Commit, RollBack, Savepoint, PL/SQL : %Type, %Rowtype, Exception, Cursor etc. [6]
6. **Transaction Management and Concurrency Control :** Transaction – properties (ACID), states, Concurrency – control, locks, two phase locking serialization [4]
7. **Distributed Databases :** Standalone v/s Distributed databases, Replication, Fragmentation, Client/Server architecture, types of distributed databases. [4]
8. **Database Recovery :** Need for recovery, techniques – log based recovery, check point, differed and immediate updates, shadowing, Catastrophic and non-catastrophic failures, Recovery in multi-database environments, Two phase commit protocol [4]
9. **Query Processing :** Steps in query processing, advantages of optimization [2]
10. **Object – Relational Databases :** Abstract Datatypes, Nested Tables, Varying Arrays, Large Objects, Naming Conventions for Objects .[4]

References :

1. Database System Concepts by Korth, Silberschatz, Sudarshan - McGraw Hill
2. Fundamentals of Database Systems by Navathe, Elmasari - Addison Wesley
3. Introduction to Database Systems by Date - Addison Wesley
4. Oracle 8i – The Complete Reference, by Kevin Loney, Geroge Koch - Tata McGraw Hill

CS-205 : Project –II

Project work

CS-206 : Practical –II (VB6.0 and DBMS)

Practical Assignment of minimum 20 based on papers CS-201, CS-202 and CS-204. These assignments may be implemented by using VB6.0.

VB 6.0

Various controls, basics constructs and loops , Arrays – dynamic arrays, control arrays, Exploring Forms:- Form as an object, load, unload, hide and show a form, SDI and MDI, working with toolbar, working with menusDatabase Programming using ADO, Data Report

Reference Books :

1) Essential Visual Basic : Mark Steven, Heyman
2) Mastering Visual Basic – Pebroutsos – BPB
3) Visual Basic in Recent time – Brown – BPB