Solapur University, Solapur

M.Sc. (Computer Science)

Syllabus (Semester – I and II)

Choice Based Credit System Syllabus
(w.e.f. June 2015-16)

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 every semester. At present a student has to pay tuition fees Rs.4000 /- per semester, laboratory fee Rs.6000/-per semester 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/ Practical / 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 No.	Paper Code	Title of the Paper	Contact hours/week	Distribution of Marks for Examination			Credits
				Internal	University	Total	
I	CS-101	Object Oriented Programming using C++	04	30	70	100	04
II	CS-102	Numerical Analysis	04	30	70	100	04
III	CS-103	Software Engineering	04	30	70	100	04
IV	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 No.	Paper Code	Title of the Paper	Contact hours/week	Distribution of Marks for Examination			Credits
				Internal	University	Total	
V	CS-201	Java Programming	04	30	70	100	04
VI	CS-202	Computer Communication Network	04	30	70	100	04
VII	CS-203	UML	04	30	70	100	04
VIII	CS-204	DBMS	04	30	70	100	04
	CS-205	Project - II	02	30	70	100	04
	CS-206	Practical – II	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

Paper – I
CS-101 : Object Oriented Programming using C++

Unit – I :

1. 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]
2. 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 [5]
3. 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. [6]

Unit – II :

1. Constructor & Destructor : Introduction, Constructor, access specifiers for constructors, and instantiation, Parameterized Constructor, Multiple Constructor in A Class, Constructor with Default Argument, Copy Constructor, Destructor.[7]
2. 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, Overloading << And . [8]

Unit – III :

1. 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 . [8]
2. Virtual Functions & Polymorphism : Virtual Function, Pure Virtual Functions, Early Vs. Late Binding. [3]

3. Exception handling in C++, try, throw, catch sequence, multiple catch blocks, uncaught exceptions, catch-all exception handler [4]

Unit – IV :

1. Templates: Reason for templates compactness and flexibility, function template examples explicit specialization, class templates, out of class definition of member functions [7]
2. 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. [8]

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

Paper - II

CS-102 Numerical Analysis

Unit – I :

Errors in numerical calculations and solution of algebraic and transcendental equations [15]

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.

Unit – II :

Interppolation and Numerical Differentiation. [15]

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.

Unit – III :

Numerical solutions of system of linear equations & Eigen Values. [15]

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

Unit – IV :

Numerical Integration and Solutions of ordinary differential equations [15]

Numerical Integration: Trapezoidal 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

Reference 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
3) Atkinson K. E., An Introduction to Numerical Analysis, John Wiley and Sons, N. Y., 1978.
4) Froberg C. E., Introduction to Numerical Analysis, Johns Hopkins University Press, Baltimore, 1950.

Paper - III
CS-103: Software Engineering

Unit – I :

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. [10]

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. [5]

Unit – II :

1. Analysis Concepts And Principles: Requirement analysis, communication techniques, analysis principles, software prototyping & Specification. [7]

2. Analysis Modeling: Elements of the analysis model, data modeling, functional modeling, behavioral modeling, the mechanics of structured analysis, data dictionary, other classical analysis methods. [8]

Unit – III :

1. 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. [15]

Unit – IV :

1. Software Testing Methods: Fundamentals, Test case design, White box testing, basis path testing, control structure testing, black box testing, Software testing strategies. [8]

2. 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. [7]

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.

Paper - IV
CS-104 : Data Structures

Unit – I :

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. **Stacks** : Processing the stacks, Linked list implementation, Application of Stacks for expression solving, Non recursive implementation of recursive algorithms. [7]

Unit – II :

1. **Queues** : Processing the queues, Linked list implementation, Dequeues, Priority queues and their applications. [6]

2. **Linked List :** Processing linked list, Circularly linked list, Doubly linked list, Multilinked lists, String and characters manipulation using arrays and linked list. [9]

Unit – III :

1. **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]

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

Unit – IV :

1. **Sorting and searching** : Various sorts viz. Insertion, Bubble sort, Selection sort, Quick sort, Merge sort, Radix / Bucket sort, Counting sort, searching algorithms and their complexities, . Binary tree indexing, B-tree indexing, Hash indexing [15]

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

Paper - V
CS-201 : Java Programming

Unit – I :

1. **Introduction to Java:** Importance and features of java, keywords, constants, variables and data types, Operators and expressions, Decision making, branching and looping: if..else, switch, ?: operator, while, do, for statements, labeled loops, jump statements : break, continue, return. (6)

2. **Classes and Objects :** defining a class, adding variables and methods, creating objects, constructors, class inheritance. (4)

3. **Arrays and strings:** creating an array, one and two dimensional arrays, string array and methods, String and StringBuffer classes, Wrapper classes. (5)

Unit – II :

1. **Inheritance:** Basics types, using super, Multilevel hierarchy abstract and final classes, Object class, Packages and interfaces, Access protection, Extending Interfaces, packages. (5)
2. **Exception Handling:** Fundamentals , exception types, uncaught exceptions, throw, final, built in exception, creating your own exceptions. (4)
3. **Multithreaded Programming:** Fundamentals of Java thread model, priorities, synchronization, messaging, thread class, Runnable interface, interthread Communication, suspending, resuming and stopping threads. (6)

Unit – III :

1. **Event Handling:** Event Model, Event Classes, Event Listener Interfaces, Adapter and Inner Classes, Working with windows, graphics and text, using AWT controls, Layout managers and menus, handling Image, animation, sound and video, Java Applet.(15)

Unit – IV :

1. Input/Output: Basics, Streams, Byte and Character stream, predefined streams, Reading and writing from console and files. Using Standard Java Packages (lang, util, io, net). (8)

2. JDBC: JDBC API, JDBC Drivers, Products, JDBC Design considerations, Basic steps to JDBC, setting up a connection to database, Creating and executing SQL statements (7)

References :

1. "Java-2 the complete Reference" by Patrick Naughton and Herbertz Schidt.
2. "Programming with Java" by E Balaguruswamy.
3. Horstmann, "Computing Concepts with Java 2 Essentials", John Wiley.
4. Decker & Hirshfield, "Programming Java", Vikas Publication.

CS-202 : Computer Communication Network

Unit – I :

1. Introduction

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, Relationship of Services to Protocols;

Example of Networks: The Internet, The ARPANET, NSFNET, Internet usage, Architecture of the internet. (7)

2. Data Link Layer

Data Link Layer Design Issues: Services Provided to the Network Layer, Framing, Error Control, Flow Control;

Error Detection and Correction: Error-Correcting Codes, Error-Detecting Codes;

Elementary Data Link Protocols: An Unrestricted Simplex Protocol, A Simplex Stop-and-Wait Protocol, A Simplex Protocol for a Noisy Channel;

Sliding Window Protocols: A One-Bit Sliding Window Protocol, A Protocol Using Go Back N, A Protocol Using Selective Repeat;

Example Data Link Protocols: HDLC—High-Level Data Link Control, The Data Link Layer in the Internet. (8)

Unit II :

1. Network Layer

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,

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, Mobile IP; IPV6. (15)

Unit – III :

1. The Transport Layer

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 – UDP: Introduction to UDP, Remote Procedure Call, The Real-Time Transport Protocol;
The Internet Transport Protocols – TCP: Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, Modeling TCP Connection Management TCP Transmission Policy, TCP Congestion Control, Wireless TCP and UDP (15)

Unit – IV :

1. The Application Layer

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. (15)

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.

Paper - VII
CS-203 : UML

Unit – I :

1. Object Oriented Design and Modeling: Object Oriented Fundamentals, Objects and object classes, object oriented design process, importance of modeling, principles of modeling, object oriented modeling. [7]

2. Introduction to UML: Conceptual model of UML, building blocks of UML, Mechanisms in UML, architecture, software development life cycle. [8]

Unit – II :

1. Basic Structural Modeling: Classes, relationships, common mechanisms, class and object diagrams. [8]

2. Advanced structural Modeling: Advanced classes, advanced relationships, Interfaces types and roles, packages, instances and object diagrams. [7]

Unit – III :

1. 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]

2. Basic behavioral modeling: Interactions use cases, Use Case Diagrams, Interaction Diagrams and activity diagrams. [7]

Unit – IV :

1. Advanced behavioral modeling: Events and signals, state machines, process and threads, time and space, state chart diagrams. [8]

2. Architectural Modeling: Terms, Concepts, examples, Modeling techniques for component diagrams and deployment diagrams. [7]

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

Paper - VIII

CS-204 : DBMS

Unit – I:

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. [5]
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 [8]

Unit – II:

1. **Relational Database Systems :** Characteristics, relation, attribute, tuple, domain, null, Normalization, Functional Dependencies, Multivalued Dependencies, 1NF, 2NF, 3NF, 4NF, 5NF Boyce codd's normal form [7]
2. **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. [8]
3.

Unit – III :

1. **Transaction Management and Concurrency Control :** Transaction – properties (ACID), states, Concurrency – control, locks, two phase locking serialization [8]
2. **Distributed Databases :** Standalone v/s Distributed databases, Replication, Fragmentation, Client/Server architecture, types of distributed databases. [7]

Unit – IV :

1. **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 [6]
2. **Query Processing :** Steps in query processing, advantages of optimization [3]
3. **Object – Relational Databases :** Abstract Datatypes, Nested Tables, Varying Arrays, Large Objects, Naming Conventions for Objects [6]

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

Minimum 20 Practical Assignments based on papersCS-201, CS-202 and CS-204