

P.V.G.'s College of Science, Pune 9

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Syllabus of F.Y. M.Sc. (Computer Science) Course

Academic Year 2013-14

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University of Pune

Two Year M.Sc. Degree Course in Computer Science

M.Sc. Computer Science

**(Credit and Semester based Syllabus for affiliated colleges to be implemented
from Academic Year 2013-14)**

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1) Title of the Course:

M.Sc. (Computer Science)

2) Preamble of the Syllabus:

This syllabus is the extension of the existing syllabus which is currently being taught to M.Sc. (Computer Science) of University of Pune for the last few years, but modified to be placed within the credit based system to be implemented from the academic year 2013-2014. However, there are few changes incorporated in the existing syllabus.

It is believed that the proposed changes as part of the credit based system will bring a qualitative change in the way M.Sc. (Computer Science) is taught, which will offer a more enriched learning experience. It aims to provide technology-oriented students with the knowledge and ability to develop creative solutions, and better understand the effects of future developments of computer systems and technology on people and society.

The syllabus is about developing skills to learn new technology, grasping the concepts and issues behind its use and the use of computers.

3) Introduction:

Salient Features of the Credit System:

1. Master's degree in Computer Science would be of 100 credits, where one credit course of theory will be of one clock hour per week running for 15 weeks and one credit for project course will consist of 15 of laboratory hours. Thus, each credit will be equivalent to 15 hours.
2. Student will have to take admission and complete at least 75 credits incorporated in the syllabus structure of Computer Science. The remaining 25 credits can be chosen from courses offered by the other Departments subjects (other than Computer Science courses) of the College with credit system structure.
3. Every student shall complete 100 credits in a minimum of four semesters. All Semesters will have 25 credits each.
4. The student will be declared as failed if s/he does not pass in all credits within a total period of four years. After that such students will have to seek fresh admission as per admission rules prevailing at that time.

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5. Academic calendar showing dates of commencement and end of teaching, internal assessment tests and term end examination will be prepared and duly notified before commencement of each semester every year.
6. Project course should not be greater than 10% of the total credits of the degree course. Project course is equivalent to 10 credits.

Instructions for the Students

The students seeking admission to M.Sc. Computer Science course is hereby informed that they are supposed to adhere to the following rules:

1. A minimum of 75 % attendance for lectures / practical is the pre-requisite for grant of term.
2. There shall be tutorial / practical / surprise test / home assignment / referencing of research papers / seminar / industrial visits as a part of internal assessment in each semester. The students are supposed to attend all the tests. The students should note that re-test will not be given to the student absent for the test/s.
3. The students opting for dissertation course shall follow the rules framed for the same.

4) Eligibility:

The candidate should have a B.Sc. degree with Computer Science as principal subject.

Admission : Admissions will be given as per the selection procedure / policies adopted by the respective college, in accordance with conditions laid down by the University of Pune. Reservation and relaxation will be as per the government rules.

5) Examination

[A] 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 if s/he fails to complete the 50% credits of the total expected within two semesters.
- 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

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the discretion of the concerned teacher and internal departmental assessment committee.

- 5) There shall be reevaluation of answer script of end semester examination, but not of internal assessment papers.
- 6) Internal assessment answer scripts may be shown to the concerned student but not end semester answer script.

i. 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

a) 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.

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

[B] Standard of Passing

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.

[C] ATKT Rules

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A student cannot register for third semester if s/he fails to complete the 50% credits of the total credits expected to be ordinarily completed within two semesters.

[D] 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 100 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 30 credits worth theory courses.
6. Grade improvement programme will be implemented at the end of the academic year. A student can opt for grade improvement programme only after the declaration of final semester examination i.e. at the end of next academic year after passing M.Sc. (Computer Science) examination and within two years of completion of M.Sc. (Computer Science). A student can appear for grade improvement programme only once.

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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):

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

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

[E] External Students: There shall be no external students.

[F] 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 guidelines.

[G] 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.

6) Structure of Course

- Duration : The entire Programme is a Two year and four semester full time Programme.
- No of Courses : For first three semesters there will be Five courses. The fourth semester will be Industrial Training/Institutional Project and two theory courses.

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Year/ Semester	Subject	Paper	Title of Paper	Credit	% of Assessment		
					IA	UE	Total
I Year Sem-I	Core	CS-101	Principles of Programming Languages	5	50	50	100
	Core	CS-102	Advanced Networking	5	50	50	100
	Core	CS-103	Distributed Database Concepts	5	50	50	100
	Core	CS-104	Design and Analysis of Algorithms	5	50	50	100
	Core	CS-105	Network Programming	5	50	50	100

Minimum Credit : 25 Maximum 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	CS-201	Digital Image Processing	4	5	50	50	100
	Core	CS-202	Advanced Operating Systems	4	5	50	50	100
	Core	CS-203	Data Mining and Data Warehousing	4	5	50	50	100
	Core	CS-204	Project	4	5	50	50	100
	Elective	CS-205	Programming With DOT NET	4	5	50	50	100
	Elective	CS-206	Artificial Intelligence	4	5	50	50	100
	Elective	CS-207	Advance Design and Analysis of Algorithms	4	5	50	50	100

Minimum Credit : 25 Maximum Credit : 30. 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	Credit	% of Assessment		
					IA	UE	Total
II Year Sem-III	Core	CS-301	Software Metrics & Project Management	5	50	50	100
	Core	CS-302	Mobile Computing	5	50	50	100
	Core	CS-303	Soft Computing	5	50	50	100
	Elective	CS-304	Project	5	50	50	100
	Elective	CS-305	Web Services	5	50	50	100
	Elective	CS-306	Database and System Administrator	5	50	50	100
	Elective	CS-307	Functional Programming	5	50	50	100
	Elective	CS-308	Business Intelligence	5	50	50	100

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Minimum Credit : 25 Maximum Credit : 35, Core Subject is compulsory, From elective courses student can select two course for minimum credit and four for maximum credit. IA :- Internal Assessment, UE :- University Examination

Year/ Semester	Subject	Paper	Title of Paper	Credit	% of Assessment		
					IA	UE	Total
II Year Sem-IV	Core	CS-401	Industrial Training /Institutional project	15	50	50	100
	Elective	CS-402	Parallel Computing	5	50	50	100
	Elective	CS-403	Embedded System	5	50	50	100
	Elective	CS-404	Software Quality Assurance	5	50	50	100
	Elective	CS-405	Modeling and Simulation	5	50	50	100

Core Subject is compulsory. If student had completed 85 credit within three semesters then no need to select any elective course otherwise student should select appropriate number of elective courses to minimum complete 100 credits.

IA :- Internal Assessment, UE :- University Examination

7) Equivalence of Previous Syllabus:

Not Applicable

8) University Terms:

9) Qualification of Teacher:

10) Detail Syllabus with Recommended Books

M.Sc. (Computer Science)

First Year Semester 1

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CS-101(New): Principles of Programming Languages

[Total Lectures: 48 Hours]

Course Prerequisites:

It is assumed that student learning this course have the following background:

- Experience with an OOP language (such as Java or C++)
- Experience with a procedural language (such as C)
- Working knowledge of C, C++, and Java programming.
- Basic algorithms and data structure concepts.

Why to study this course?

- To allow Informed Design Decisions
- Gives insight when debugging
- Permits effective use of compilers/linkers interpreters and language oriented tools.
- Helps to understand how language features work.
- Learn features, emulate missing features.
- Develop a greater understanding of the issues involved in programming language design and implementation
- Develop an in-depth understanding of functional, logic, and object-oriented programming paradigms
- Implement several programs in languages other than the one emphasized in the core curriculum (Java/C++)
- Understand design/implementation issues involved with variable allocation and binding, control flow, types, subroutines, parameter passing
- Develop thorough understanding of the compilation process
- To introduce several different paradigms of programming
- To gain experience with these paradigms by using example programming languages
- To understand concepts of syntax, translation, abstraction, and implementation

Course Objectives:

- This course will prepare you to think about programming languages analytically:
 - Separate syntax from semantics
 - Compare programming language designs
 - Learn new languages more quickly
 - Use standard vocabulary when discussing languages
 - Understand basic language implementation techniques
- This course focuses on both:
 - Theory is covered by the textbook readings, lectures, and on the tests
 - Implementation is covered by the homework assignments

Unit 1. Introduction [T1 chap. 1] [2]

- The Art of Language Design [T1 1.1]
- The Programming Language Spectrum [T1 1.2]
- Why Study Programming Languages? [T1 1.3]
- Compilation and Interpretation [T1 1.4]
- Programming Environments [T1 1.5]

Unit 2. Non-Imperative Programming Models: Functional, Logic Languages

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	[Text books 3, 4]	[10]
Common LISP		
• Basic LISP Primitives (FIRST, REST, SETF, CONS, APPEND, LIST, NTHCDR, BUTLAST, LAST, LENGTH, REVERSE, ASSOC)		
• Procedure definition and binding, DEFUN, LET		
• Predicates and Conditional, EQUAL, EQ, EQL, =, MEMBER, LISTP, ATOM, NUMBERP, SYMBOLP, NIL, NULL, IF, WHEN, UNLESS, COND, CASE		
• Procedure Abstraction and Recursion		
	[T 4]	
Turbo Prolog		
Introduction, facts, Objects and Predicates, Variables, Using Rules, Controlling execution fail and cut predicates		
	[T3 chapter 1 through 9 except chapter 2]	
Unit 3. Names, Scopes, and Bindings	[T1 chap.3]	[5]
The Notion of Binding Time [T1 chap.3.1]		
Object Lifetime and Storage Management : [T1 chap. 3.2]		
Static Allocation, Stack-Based Allocation, Heap-Based Allocation, Garbage Collection		
Scope Rules T1 chap. 3.3]		
Static Scoping, Nested Subroutines, Declaration Order, Dynamic Scoping		
The meaning of Names in a Scope [T1 chap. 3.5]		
Aliases, Overloading, Polymorphism and Related Concepts		
The Binding of Referencing Environments [T1 chap. 3.6]		
Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures		
Macro Expansion [T1 chap. 3.7]		
Unit 4. Control Flow [T1 chap.6]	[5]	
Expression Evaluation [T1 6.1]		
Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions, Short-Circuit Evaluation		
Structured and Unstructured Flow [T1 6.2]		
Structured Alternatives to goto		
Sequencing [T1 6.3]		
Selection [T1 6.4]		
Short-Circuited Conditions, Case/Switch Statements		
Iteration [T1 6.5]		
Enumeration-Controlled Loops, Combination Loops, Iterators, Logically Controlled Loops		
Recursion [T1 6.6]		
Iteration and Recursion, Applicative- and Normal-Order Evaluation		
Unit 5. Data Types	[T2 chap.6]	[8]
Introduction T2 6.1]		
Primitive Data Types [T2 6.2]		
Numeric Types [T2 6.2.1]		
Integer [T2 6.2.1.1]		
Floating point [T2 6.2.1.2]		

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- Complex [T2 6.2.1.3]
- Decimal [T2 6.2.1.4]
- Boolean Types [T2 6.2.2]
- Character Types [T2 6.2.3]
- Character String Types [T2 6.3]
 - Design Issues [T2 6.3.1]
 - Strings and Their Operations [T2 6.3.2]
 - String Length Operations [T2 6.3.3]
 - Evaluation [T2 6.3.4]
 - Implementation of Character String Types [T2 6.3.5]
- User defined Ordinal types [T2 6.4]
 - Enumeration types [T2 6.4.1]
 - Designs
 - Evaluation
 - Subrange types [T2 6.4.2]
 - Ada's design
 - Evaluation
 - Implementation of user defined ordinal types [T2 6.4.3]
- Array types [T2 6.5]
 - Design issues [T2 6.5.1]
 - Arrays and indices [T2 6.5.2]
 - Subscript bindings and array categories [T2 6.5.3]
 - Heterogeneous arrays [T2 6.5.4]
 - Array initialization [T2 6.5.5]
 - Array operations [T2 6.5.6]
 - Rectangular and Jagged arrays [T2 6.5.7]
 - Slices [T2 6.5.8]
 - Evaluation [T2 6.5.9]
 - Implementation of Array Types [T2 6.5.10]
- Associative Arrays [T2 6.6]
 - Structure and operations [T2 6.6.1]
 - Implementing associative arrays [T2 6.6.2]
- Record types [T2 6.7]
 - Definitions of records [T2 6.7.1]
 - References to record fields [T2 6.7.2]
 - Operations on records [T2 6.7.3]
 - Evaluation [T2 6.7.4]
 - Implementation of Record types [T2 6.7.5]
- Union Types [T2 6.8]
 - Design issues [T2 6.8.1]
 - Discriminated versus Free unions [T2 6.8.2]
 - Evaluation [T2 6.8.4]
 - Implementation of Union types [T2 6.8.5]
- Pointer and Reference Types [T2 6.9]
 - Design issues [T2 6.9.1]
 - Pointer operations [T2 6.9.2]
 - Pointer problems [T2 6.9.3]

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- Dangling pointers
- Lost heap dynamic variables
- Pointers in C and C++ [T2 6.9.5]
- Reference types [T2 6.9.6]
- Evaluation [T2 6.9.7]
- Implementation of pointer and reference types [T2 6.9.8]
 - Representation of pointers and references
 - Solution to dangling pointer problem
 - Heap management
- Unit 6. Subroutines and Control Abstraction [T2 chap.9,10] [5]**
 - Fundamentals of Subprograms [T2 9.2 (excluding 9.2.4)]
 - Design Issues for subprograms [T2 9.3]
 - Local Referencing Environments [T2 9.4]
 - Parameter-Passing Methods [T2 9.5]
 - Parameters That are Subprograms [T2 9.6]
 - Overloaded Subprograms [T2 9.7]
 - Generic Subroutines [T2 9.8]
 - Generic Functions in C++ [T2 9.8.2]
 - Generic Methods in Java [T2 9.8.3]
 - Design Issues for Functions [T2 9.9]
 - User-Defined Overloaded Operators [T2 9.10]
 - Coroutines [T2 9.10]
 - The General Semantics of Calls and Returns [T2 10.1]
 - Implementing "Simple" Subprograms [T2 10.2]
 - Implementing Subprograms with Stack-Dynamic Local Variables [T2 10.3]
 - Nested Subprograms [T2 10.4]
 - Blocks [T2 10.5]
 - Implementing Dynamic Scoping [T2 10.6]
- Unit 7. Data Abstraction and Object Orientation [T1 chap.9] [8]**
 - Object-Oriented Programming [T1 9.1]
 - Encapsulation and Inheritance [T1 9.2]
 - Modules, Classes, Nesting (Inner Classes), Type Extensions, Extending without Inheritance
 - Initialization and Finalization [T1 9.3]
 - Choosing a Constructor, References and Values, Execution Order, Garbage Collection
 - Dynamic Method Binding [T1 9.4]
 - Virtual- and Non-Virtual Methods, Abstract Classes, Member Lookup, Polymorphism, Object Closures
 - Multiple Inheritance [T1 9.5]
 - Semantic Ambiguities, Replicated Inheritance, Shared Inheritance, Mix-In Inheritance
- Unit 8. Concurrency [T2 chap. 13] [5]**
 - Introduction
 - Multiprocessor Architecture [T2 13.1.1]
 - Categories of concurrency [T2 13.1.2]
 - Motivations for studying concurrency [T2 13.1.3]

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- Introduction to Subprogram-level concurrency
 - Fundamental concepts [T2 13.2.1]
 - Language Design for concurrency. [T2 13.2.2]
 - Design Issues [T2 13.2.3]
- Semaphores
 - Introduction [T2 13.3.1]
 - Cooperation synchronization [T2 13.3.2]
 - Competition Synchronization [T2 13.3.3]
 - Evaluation [T2 13.3.4]
- Monitors
 - Introduction [T2 13.4.1]
 - Cooperation synchronization [T2 13.4.2]
 - Competition Synchronization [T2 13.4.3]
 - Evaluation [T2 13.4.4]
- Message Passing
 - Introduction [T2 13.5.1]
 - The concept of Synchronous Message Passing [T2 13.5.2]
- Java Threads
 - The **Thread** class [T2 13.7.1]
 - Priorities [T2 13.7.2]
 - Competition Synchronization [T2 13.7.3]
 - Cooperation Synchronization [T2 13.7.4]
 - Evaluation [T2 13.4.5]

Text Books:

- T1. Scott Programming Language Pragmatics, 3e(With CD) ISBN 9788131222560 Kaufmann Publishers, An Imprint of Elsevier, USA
- T2. Concepts of Programming Languages, Eighth Edition by Robert W. Sebesta, Pearson Education.
- T3. Introduction to Turbo Prolog by Carl Townsend
- T4. LISP 3rd edition by Patrick Henry Winston & Berthold Klaus Paul Horn (BPP)

Additional Reading:

Programming Languages: Principles and Paradigms, M. Gabbrielli, S. Martini, Springer, ISBN: 9781848829138

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CS102 (New) - Advanced Networking	
Unit 1. Review of Basic Concepts	[3]
TCP/IP Protocol Suite [T1 2.3]	
Underlying Technologies : LAN (802.3) T 1 3.1	
Wireless Lans (802.11) T 1 3.2	
Point-to-point WANS T 1 3.3	
Switched WANS T 1 3.4	
Unit 2. The Internet Layer Protocols	[4]
Review of IPv4 Protocol T 1 7.1,7.2,7.3,7.4,7.5	
IPv6 T 1 27.1,27.2	
Transition from IPv4 to IPv6 T 1 27.3	
ICMPv4 T 1 9.1,9.2,9.3,9.4	
ICMPv6 T 1 28.1,28.2,28.3,28.4	
Unit 3. Routing Protocols	[6]
Forwarding T 1 6.2	
Structure of a Router T 1 6.3	
Routing Tables T 1 11.1	
Intra – And Inter-Domain Routing T 1 11.2	
Distance Vector Routing T 1 11.3	
RIP T 1 11.4	
OSPF T 1 11.6	
BGP T 1 11.8	
Multicast Routing T 1 .4	
Unit 4. The Transport Layer	[6]
The Transport Service T 2 6.1	
Elements of Transport Protocols T 2 6.2	
UDP T 2 6.4.1	
TCP T 2 6.5.1 to 6.5.9	
Unit 5. Multimedia	[3]
Digitizing Audio and Video T 1 25.2	
Streaming stored Audio / Video T 1 25.4	
Streaming Live Audio / Video T 1 25.5	
Real-Time Interactive Audio / Video T 1 25.6	
RTP T 1 25.7	
RTCP T 1 25.8	
Voice Over IP T 1 25.9	
Unit 6. Introduction To Security	[2]
The need for Security T 3 1.2	
Security Approaches T 3 1.3	
Principles of Security T 3 1.4	
Types of Attacks T 3 1.5	
Unit 7. Cryptography: Concepts and Techniques	[3]
Introduction T 3 2.1	
Plain Text and Cipher Text T 3 2.2	
Substitution Techniques T 3 2.3.1,2.3.2,2.3.3,2.3.7	
Transposition Techniques T 3 2.4.1,2.4.2,2.4.3	
Symmetric and Asymmetric key cryptography T 3 2.6.1,2.6.2	

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Unit 8. Symmetric Key Algorithms	[3]
Algorithms types and modes T 3 3.2.1,3.2.2	
DES T 3 3.4	
Unit 9. Asymmetric key Algorithms	[2]
RSA T 3 4.4	
Symmetric and Asymmetric key Cryptography T 3 4.5	
Digital Signatures T 3 4.6.1,4.6.2	
Unit 10. Digital Certificates	[2]
Introduction T 3 5.1	
Digital Certificates T 3 5.2	
Unit 11. Internet Security Protocols	[10]
Secure Socket Layer T 3 6.3	
TLS T 3 6.4	
SHTTP T 3 6.5	
TSP T 3 6.6	
SET T 3 6.7	
SSL Verses SET T 3 6.8	
3-D Secure Protocol T 3 6.9	
Electronic Money T 3 6.10	
Email Security T 3 6.11	
Firewalls T 3 9.3	
IP Security T 3 9.4	
VPN T 3 9.5	
Unit 12. User Authentication	[4]
Passwords T 3 7.3	
Certificate-based Authentication T 3 7.5	
Kerberos T 3 7.7	
Security Handshake Pitfalls T 3 7.9	

Text Books:

T1 : TCP / IP Protocol Suite Fourth Edition – Behrouz A. Forouzan

T2 : Computer Networks Fourth Edition – Andrew Tanenbaum

T3 : Cryptography and Network Security Second Edition – Atul Kahate

Supplementary but very useful references/texts: (Few of the references below contain latest research and trends related to Networks and Security and are useful for seminar/ presentations by the students.)

1. Computer Network Security, Kizza, Springer, 9780387204734
2. Guide to Computer Network Security, Kizza, Springer, 978-1-84800-916-5
3. Network Security, Harrington, Elsevier, ISBN 9788131202166
4. Douglas E. Comer, Internetworking with TCP/IP, Vol. 1, Principles, Protocols and Architecture Fifth Edition, Prentice Hall, 2000, ISBN 0-13-018380-6.
5. William Stallings, Data and Computer Communications , Seventh Edition, Pearson Education
6. Douglas E. Comer, Internetworking with TCP/IP, Vol. 2, Design, Implementation and Internals, Prentice Hall Publisher.

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

7. Internetworking with TCP/IP, Vol. 3, Client-server Programming and Applications by Douglas E. Comer, Prentice Hall Publisher. (Excellent reference for distributed programming over TCP/IP networks)
8. Richard Stevens, TCP/IP Illustrated, Vol. 1, by, Addison Wesley (A very practical book with lots of useful network diagnostic tools and programs.)
9. Craig Hunt, TCP/IP Network Administration O'Reilly & Associates, Inc. (A must for network and system administrators dealing with internetworking.)
10. L. Peterson and B. Davie. Morgan , Computer Networks: A Systems Approach by Kaufmann Publishers Inc., ISBN 9788131210451
11. J. Kurose, K. Ross ``Computer Networking: A Top-Down Approach Featuring the Internet" Addison-Wesley, '00
12. William Stallings," Cryptography And Network Security" Prentice Hall /Pearson Education

Guidelines to paper setters:

Frame formats of protocols are not expected

Problems should be asked on Routing Protocols , TCP, Cryptography, RSA

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-103(New): Distributed Database Concepts

Pre-requisites: Students should be well-versed with the basic and advanced concepts of RDBMS

Objectives:

Main objective is to understand the principles and foundations of distributed databases. This course addresses architecture, design issues, integrity control, query processing and optimization, transactions, and concurrency control & distributed transaction reliability.

Unit 1. Distributed databases: An overview	[2]
1.1 Features of distributed Vs centralized databases Chapter 1 from Book 2	
1.2 Why DDB? DDBMS	
1.3 Promises / problem areas in implementing a DDB Section 1.3,1.5 from Book 1	
Unit 2. DDBMS Architecture	[4]
2.1 DBMS Standardization Chapter 4 from Book 1	
2.2 Architectural models for DDBMS	
2.3 DDBMS architecture	
2.4 Distributed catalog management Section 21.8 from Book 3	
Unit 3. Distributed database design	[10]
3.1 Alternative design strategies Chapter 5 from book 1	
3.2 Distributed design issues	
3.3 Concepts of join graphs Section 4.2.1.2 from book 2	
3.4 Fragmentation and allocation Chapter 5 from Book1	
Unit 4. Overview of Query processing	[4]
4.1 Query processing problems	
4.2 Objectives of query processing Chapter 7 from book 1	
4.3 Complexity of relational algebra operators	
4.4 Characterization of query processors	
4.5 Layers of query processing	
Unit 5. Query decomposition & data localization	[2]
5.1 Query decomposition	
5.2 Localization of distributed data 8 from book 1	
Unit 6. Optimization of distributed queries	[10]
6.1 Query optimization	
6.2 Centralized query optimization Join ordering in fragment queries. Distributed query optimization algorithms Chapter 9 from book1	
6.3 Join ordering in fragment queries	
6.4 Distributed query optimization algorithms	
Unit 7. Management of distributed transactions	[2]
7.1 Framework for transaction management Chapter 7 from book 2	
7.2 Supporting atomicity of distributed transactions	
7.3 Concurrency control of distributed transactions	
7.4 Architectural aspects of distributed transactions	
Unit 8. Concurrency control	[6]
8.1 Foundations of distributed concurrency control Chapter 8 from book 2	
8.2 Distributed deadlocks	

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Course Catalog for M. Sc. (Computer Science) Program

- 8.3 Concurrency control based on timestamps
- 8.4 Optimistic methods for distributed concurrency control

Unit 9. Distributed DBMS reliability [8]

- 9.1 Reliability concepts & measures
- 9.2 Failures & fault tolerance in distributed systems from book 1
- 9.3 Failures in DDBMS
- 9.4 Local reliability protocols
- 9.5 Distributed reliability protocols
- 9.6 Dealing with site failures
- 9.7 Network partitioning

Reference Books:

1. Principles of Distributed Database Systems; 2nd Edition By M. Tamer Ozsu and Patrick Valduriez Publishers: Pearson Education Asia ISBN: 81-7808-375-2
2. Distributed Database; Principles & Systems By Stefano Ceri and Giuseppe Pelagatti Publications: McGraw-Hill International Editions ISBN: 0-07-010829-3
3. Database systems (2nd edition) By Raghuramakrishnan and Johannes

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-104(New): Design and Analysis of Algorithms

Prerequisites

- Basic algorithms and data structure concepts.
- Basic programming concepts

Objectives

This course will prepare students in

- Basic Algorithm Analysis techniques and understand the use of asymptotic notation
- Understand different design strategies
- Understand the use of data structures in improving algorithm performance
- Understand classical problem and solutions
- Learn a variety of useful algorithms
- Understand classification of problems

Unit 1. Analysis

Algorithm definition, space complexity, time complexity, worst case –best case –average case complexity, asymptotic notation, sorting algorithms (insertion sort, heap sort) , sorting in linear time, searching algorithms, recursive algorithms (Tower of Hanoi , Permutations).

[T1 1.1 , 1.2, 1.3] [6]

Unit 2. Design strategies

Divide and conquer-control abstraction, binary search, merge sort, Quick sort, Strassen's matrix multiplication [T1 3.1, 3.2, 3.4,3.5,3.7] [6]

Unit 3. Greedy method- knapsack problem, job sequencing with deadlines, minimum-cost spanning trees, Kruskal and Prim's algorithm, optimal storage on tapes, optimal merge patterns, Huffman coding [T1 4.1, 4.2, 4.4, 4.5, 4.6,4.7, 4.8] [8]

Unit 4. Dynamic programming- matrix chain multiplication, . single source shortest paths, Dijkstra's algorithm, Bellman- ford algorithm , all pairs shortest path, longest common subsequence, string editing, 0/1 knapsack problem, Traveling salesperson problem.

[T1 5.1, 5.3, 5.6, 5.7, 5.9] [8]

Unit 5. Decrease and conquer: - DFS and BFS, Topological sorting, connected components

[T6.1, 6.2, 6.3, 6.4] [6]

Unit 6. Backtracking: General method, 8 Queen's problem, Sum of subsets problem, graph coloring problem, Hamiltonian cycle

[T1 7.1 , 7.2, 7.3, 7.4, 7.5] [4]

Unit 7. Branch and Bound Technique : FIFO, LIFO, LCBB, TSP problem, 0/1 knapsack problem

[T1 8.1.1, 8.2, 8.3] [4]

Unit 8. Transform and conquer:- Horner's Rule and Binary Exponentiation – Problem Reduction –

[T1 9.1, 9.2 ,9.3] [4]

Unit 9. Problem classification

Nondeterministic algorithm, The class of P, NP, NP-hard and NP- Complete problems, significance of Cook's theorem

[T1 11.1] [2]

Text Books

T1. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, Computer Algorithms, Galgotia.

T2 T. Cormen, C. Leiserson, & R. Rivest, Algorithms, MIT Press, 1990

References Texts

- 1) A. Aho, J. Hopcroft, & J. Ullman, The Design and Analysis of Computer Algorithms, M.Sc.(CS) syllabus for affiliated colleges

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Course Catalog for M. Sc. (Computer Science) Program

- Addison Wesley, 1974
- 2) Donald Knuth, The Art of Computer Programming (3 vols., various editions, 1973-81), Addison Wesley
- 3) The Algorithm Manual, Steven Skiena, Springer ISBN:9788184898651
- 4) Graphs, Networks and Algorithms, Jungnickel, Springer, ISBN: 3540219056

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-105 (New) : Network Programming

Prerequisites:

- Working Knowledge of C
- Basic Understanding of Networking Concepts
- User Level Knowledge of Linux

Syllabus:

[Total Lectures: 48]

UNIT 1: Introduction

[2]

- A Simple Daytime Client, Protocol Independence, Error Handling: Wrapper Functions, A Simple Daytime Server [Book-1]

UNIT 2: Sockets Introduction

[6]

- Socket Address Structures, Value-Result Arguments, Byte Ordering Functions, Byte Manipulation Functions, inet_aton, inet_addr, and inet_ntoa Functions, inet_pton and inet_ntop Functions, sock_ntop and Related Functions, readn, writen, and readline Functions, isfdtype Function [Book-1]
- What is a Socket?, Using Sockets [Book-2]

UNIT 3: Elementary TCP Sockets

[4]

- socket Function, connect Function, bind Function, listen Function, accept Function, fork and exec Functions, Concurrent Servers, close Function, getsockname and getpeername Functions [Book-1]

UNIT 4: TCP Client-Server Example

[6]

- TCP Echo Server: main Function, TCP Echo Server: str_echo Function, TCP Echo Client: main Function, TCP Echo Client: str_cli Function, Normal Startup, Normal Termination, Connection Abort before accept Returns, Termination of Server Process, SIGPIPE Signal, Crashing of Server Host, Crashing and Rebooting of Server Host, Shutdown of Server Host [Book-1]

UNIT 5: I/O Multiplexing: The select and poll Functions

[6]

- I/O Models, select Function, str_cli Function (Revisited), Batch Input, shutdown Function, str_cli Function (Revisited Again), TCP Echo Server (Revisited), pselect Function, poll Function, TCP Echo Server (Revisited Again) [Book-1]

UNIT 6: Socket Options

[4]

- getsockopt and setsockopt Functions, Checking If an Option Is Supported and Obtaining the Default, Socket States, Generic Socket Options, IPv4 Socket Options, ICMPv6 Socket Option, IPv6 Socket Options, TCP Socket Options [Book-1]

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UNIT 7: Elementary UDP Sockets

[8]

- recvfrom and sendto Functions, UDP Echo Server: main Function, UDP Echo Server: dg_echo Function, UDP Echo Client: main Function, UDP Echo Client: dg_cli Function, Lost Datagrams, Verifying Received Response, Server Not Running, Summary of UDP example, connect Function with UDP, dg_cli Function (Revisited), Lack of Flow Control with UDP, Determining Outgoing Interface with UDP, TCP and UDP Echo Server Using select [Book-1]
- User Datagram Protocol, File Transfer, Error Handling [Book-2]

UNIT 8: Protocols, Sessions, State, and Implementing Custom Protocols

[4]

- State vs. Stateless, Methods for Maintaining State, What Is a Protocol?, Designing a Custom Protocol, Our Chat Protocol, Protocol Registration [Book-2]

UNIT 9: Elementary Name, Address Conversions and design decisions

[8]

- Domain Name System, gethostbyname Function, RES_USE_INET6 Resolver Option, gethostbyname2 Function and IPv6 Support, gethostbyaddr Function, uname Function, gethostname Function, getservbyname and getservbyport Functions [Book-1]
- TCP vs. UDP, Application Protocol Choices, Client-Server Architecture, Client-Side Considerations, Server-Side Considerations [Book-2]

References:

T1: Unix Network Programming, Volume 1: The Sockets Networking API, 3/E by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, PHI

T2: The Definitive Guide to Linux Network Programming by KEIR DAVIS, JOHN W. TURNER, AND NATHAN YOCOM, Apress.

M.Sc. (Computer Science)

First Year Semester 2

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Course Catalog for M. Sc. (Computer Science) Program

CS-201: Digital Image Processing

Syllabus:	[Total Lectures: 48]
UNIT 1. Introduction	[3]
<ul style="list-style-type: none">• What is Digital Image Processing?• The origins of Digital Image Processing• Examples of Fields that use Digital Image Processing<ul style="list-style-type: none">▪ Gamma-Ray Imaging▪ X-Ray Imaging▪ Imaging in the Ultraviolet Band▪ Imaging in the Visible and Infrared Bands▪ Imaging in the Microwave Band▪ Imaging in the Radio Band• Fundamental steps in Digital Image Processing• Components of an Image Processing System	
UNIT 2. Digital Image Fundamentals	[6]
<ul style="list-style-type: none">• Elements of Visual Perception• Light and the Electromagnetic Spectrum• Image sensing and Acquisition• Image Sampling and Quantization• Some Basic Relationships between Pixels• An Introduction to the Mathematical Tools Used in Digital Image Processing<ul style="list-style-type: none">▪ Array versus Matrix Operations▪ Linear versus Nonlinear Operations▪ Arithmetic Operations▪ Set and Logical Operations	
UNIT 3. Intensity Transformation and Spatial Filtering	[7]
<ul style="list-style-type: none">• Background• Some Basic Intensity Transformation Functions• Histogram Processing<ul style="list-style-type: none">▪ Histogram Equalization▪ Histogram Matching (Specification)▪ Local Histogram Processing• Fundamentals of Spatial Filtering• Smoothing Spatial Filters• Sharpening Spatial Filters• Combining Spatial Enhancement Methods	
UNIT 4. Filtering in the Frequency Domain	[10]
<ul style="list-style-type: none">• Background• Preliminary Concepts• Sampling and the Fourier Transform of Sampled Functions• The Discrete Fourier Transform (DFT) of One variable• Extension to Functions of Two Variables	

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Course Catalog for M. Sc. (Computer Science) Program

- Some Properties of the 2-D Discrete Fourier Transform
 - The Basics of Filtering in the Frequency Domain
 - Image Smoothing Using Frequency Domain Filters
 - Image Sharpening Using Frequency Domain Filters
 - Selective Filtering
- UNIT 5. Image Restoration and Reconstruction [6]
- A Model of the Image Degradation / Restoration Process
 - Noise Models
 - Restoration in the Presence of Noise Only- Spatial Filtering
 - Periodic Noise Reduction by Frequency Domain Filtering
 - Bandreject Filters
 - Bandpass Filters
 - Notch Filters
 - Estimating the Degradation Function
 - Inverse Filtering
 - Minimum Mean Square Error(Wiener) Filtering
 - Geometric Mean Filter
- UNIT 6. Morphological Image Processing [5]
- Preliminaries
 - Erosion and Dilation
 - Opening and Closing
 - The Hit-or-Miss Transformation
 - Some Basic Morphological Algorithms
 - Boundary Extraction
 - Hole Filling
 - Extraction of Connected Components
 - Convex Hull
 - Thinning
 - Thickening
 - Skeletons
 - Pruning
 - Morphological Reconstruction
- UNIT 7. Image Segmentation [7]
- Fundamentals
 - Point, Line, and Edge Detection
 - Background
 - Detection of Isolated Points
 - Line Detection
 - Edge Models
 - Basic Edge Detection
 - Edge Linking and Boundary Detection
 - Thresholding
 - Foundation
 - Basic Global Thresholding
 - Optimum Global Thresholding Using Otsu's Method

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- Using Image Smoothing to Improve Global Thresholding
 - Using Edges to Improve Global Thresholding
 - Region-Based Segmentation
- UNIT 8. Representation and Description [4]
- Representation
 - Boundary (Border) Following
 - Chain Codes
 - Polygonal Approximations Using Minimum-Perimeter Polygons
 - Other Polygonal Approximation Approaches
 - Signatures
 - Boundary Segments
 - Skeletons
 - Boundary Descriptors
 - Some Simple Descriptors
 - Shape Numbers
 - Fourier Descriptors
 - Regional Descriptors
 - Some Simple Descriptors
 - Topological Descriptors
 - Texture

Text Book:

1. Gonzalez, R. C. and Woods, R. E. [2002/2008], Digital Image Processing, 3rd ed., Prentice Hall

Reference Books:

1. Sonka, M., Hlavac, V., Boyle, R. [1999]. Image Processing, Analysis and Machine Vision (2nd edition), PWS Publishing, or (3rd edition) Thompson Engineering, 2007
2. Gonzalez, R. C., Woods, R. E., and Eddins, S. L. [2009]. Digital Image Processing Using MATLAB, 2nd ed., Gatesmark Publishing, Knoxville, TN.
3. Anil K. Jain [2001], Fundamentals of digital image processing (2nd Edition), Prentice-Hall, NJ
4. William K. Pratt [2001], Digital Image Processing (3rd Edition), , John Wiley & Sons, NY
5. Burger, Wilhelm and Burge, Mark J. [2008]. Digital Image Processing: An Algorithmic Introduction Using Java, Springer
6. Digital Image Analysis (With CD-ROM), Kropatsch, Springer, ISBN 978038795066
7. Digital Image Processing, 6e (With CD), Jähne, Springer, ISBN:978-3-540-24035-8 2

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-202(New): Advanced Operating Systems

Prerequisites:

- Working knowledge of C programming.
- Basic Computer Architecture concepts.
- Basic algorithms and data structure concepts.

Course Objectives:

This course teaches Advanced Operating Systems Concepts using Unix/Linux and Windows as representative examples. This course strikes a delicate balance between theory (covered in TextBook-2, 3) and practical applications (covered in TextBook-1, 4). In fact, most Units start with the theory and then switches focus on how the concepts are implemented in a C program. This course describes the programming interface to the Unix/Linux system - the system call interface. It is intended for anyone writing C programs that run under Unix/Linux. Finally, it concludes with an overview of Windows Threads Management. This course provides an understanding of the functions of Operating Systems. It also provides provide an insight into functional modules of Operating Systems. It discusses the concepts underlying in the design and implementation of Operating Systems.

Syllabus:

Unit 1. Introduction to UNIX/Linux Kernel

[03]

- System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System (TextBook-3: Chapter Topics: 1.2, 1.3, 1.5, 2.1)
- Concepts of Linux Programming- Files and the Filesystem, Processes, Users and Groups, Permissions, Signals, Interprocess Communication (TextBook-1: Chapter 1- relevant topics)

Unit 2. File and Directory I/O

[13]

- Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, inodes, structure of regular file, open, read, write, lseek, close, pipes, dup (TextBook- 3: Chapter Topics: 3.1-3.4, 4.1, 4.2, 5.1-5.3, 5.5-5.7, 5.12, 5.13)
- open, creat, file sharing, atomic operations, dup2, sync, fsync, and fdatasync,fcntl, /dev/fd, stat, fstat, lstat, file types, Set-User-ID and Set-Group-ID, file access permissions, ownership of new files and directories, access function, umask function, chmod and fchmod, sticky bit, chown, fchown, and lchown, file size, file truncation, file systems, link, unlink, remove, and rename functions, symbolic links, symlink and readlink functions, file times, utime, mkdir and rmdir, reading directories, chdir, fchdir, and getcwd, device special files (TextBook-4: Chapter Topics: 3.3, 3.4, 3.10-3.14, 3.16, 4.2-4.23)
- Scatter/Gather I/O, Mapping Files into Memory, Advice for Normal File I/O, I/O Schedulers and I/O Performance, Directories, Copying and Moving files, Device Nodes, Out-of-Band Communication (TextBook-1: Chapters: 4 and 7-relevant topics)

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Course Catalog for M. Sc. (Computer Science) Program

- Unit 3. Process Environment, Process Control and Process Relationships [14]
- Process states and transitions, layout of system memory, the context of a process, saving the context of a process, sleep, process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, changing the size of the process, The Shell, Process Scheduling (TextBook-3: Chapter Topics: 6.1-6.4, 6.6, 7.1-7.8, 8.1)
 - Process termination, environment list, memory layout of a C program, shared libraries, environment variables, setjmp and longjmp, getrlimit and setrlimit, process identifiers, fork, vfork, exit, wait and waitpid, waitid, wait3 and wait4, race conditions, exec, changing user IDs and group IDs, system function, user identification, process times (TextBook-4: Chapter Topics: 7.3, 7.5-7.7, 7.9-7.11, 8.2-8.11, 8.13, 8.15, 8.16)
 - The Process ID, Running a New Process, Terminating a Process, Waiting for Terminated Child Processes, Users and Groups, Daemons, Process Scheduling, Yielding the Processor, Process Priorities, Processor Affinity (TextBook-1: Chapter 5 and 6 [Relevant Topics])
- Unit 4. Memory Management [06]
- The Process Address Space, Allocating Dynamic Memory, Managing Data Segment, Anonymous Memory Mappings, Advanced Memory Allocation, Debugging Memory Allocations, Stack-Based Allocations, Choosing a Memory Allocation Mechanism, Manipulating Memory, Locking Memory, Opportunistic Allocation (TextBook-1: Chapter 8)
 - Swapping, Demand Paging (TextBook-3: Chapter Topics: 9.1, 9.2)
- Unit 5. Signal Handling [06]
- Signal concepts, signal function, unreliable signals, interrupted system calls, reentrant functions, SIGCLD semantics, reliable-signal technology, kill and raise, alarm and pause, signal sets, sigprocmask, sigpending, sigsetjmp and siglongjmp, sigsuspend, abort, system function revisited, sleep (TextBook-4: Topics: 10.2-10.13, 10.15-10.19)
 - Signal Concepts, Basic Signal Management, Sending a Signal, Reentrancy, Signal Sets, Blocking Signals, Advanced Signal Management, Sending a Signal with a Payload (TextBook-1: Chapter 9)
- Unit 6. Windows Thread Management (TextBook-2: Chapter 5 [relevant topics]) [06]
- Thread Internals
 - Data Structures, Kernel Variables, Performance Counters, Relevant Functions, Birth of a Thread Examining Thread Activity : Limitations on Protected Process Threads, Worker Factories (Thread Pools)
 - Thread Scheduling
 - Overview of Windows Scheduling, Priority Levels, Windows Scheduling APIs, Relevant Tools, Real-Time Priorities, Thread States, Dispatcher Database, Quantum, Scheduling Scenarios, Context Switching, Idle Thread, Priority Boosts

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Recommended Text:

1. Linux System Programming, O'Reilly, by Robert Love.
2. Windows Internals, Microsoft Press, by Mark E. Russinovich and David A. Solomon.
3. The Design of the UNIX Operating System, PHI, by Maurice J. Bach.
4. Advanced Programming in the UNIX Environment, Addison-Wesley, by Richard Stevens.

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Course Catalog for M. Sc. (Computer Science) Program

CS-203(New): Data Mining and Data Warehousing	
Unit 1. Introduction to Data Mining	[4]
<ul style="list-style-type: none">• Basic Data Mining Tasks• DM versus Knowledge Discovery in Databases• Data Mining Issues• Data Mining Metrics• Social Implications of Data Mining• Overview of Applications of Data Mining	
Unit 2. Introduction to Data Warehousing	[4]
<ul style="list-style-type: none">• Architecture of DW• OLAP and Data Cubes• Dimensional Data Modeling-star, snowflake schemas• Data Preprocessing – Need, Data Cleaning, Data Integration & Transformation, Data Reduction• Machine Learning• Pattern Matching	
Unit 3. Data Mining Techniques	[4]
<ul style="list-style-type: none">• Frequent item-sets and Association rule mining: Apriori algorithm, Use of sampling for frequent item-set, FP tree algorithm• Graph Mining: Frequent sub-graph mining, Tree mining, Sequence Mining	
Unit 4. Classification & Prediction	[16]
<ul style="list-style-type: none">• Decision tree learning: [3 hrs] Construction, performance, attribute selection Issues: Over-fitting, tree pruning methods, missing values, continuous classes Classification and Regression Trees (CART)• Bayesian Classification: [6 hrs]• Bayes Theorem, Naïve Bayes classifier,• Bayesian Networks• Inference• Parameter and structure learning• Linear classifiers [4 hrs]• Least squares, logistic, perceptron and SVM classifiers• Prediction [3 hrs]• Linear regression• Non-linear regression	
Unit 5 Accuracy Measures	[4]
Precision, recall, F-measure, confusion matrix, cross-validation, bootstrap	
Unit 6. Software for data mining and applications of data mining	[4]
R, Weka, Sample applications of data mining	
Unit 7. Clustering	[4]
<ul style="list-style-type: none">• k-means	

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Course Catalog for M. Sc. (Computer Science) Program

- Expectation Maximization (EM) algorithm
- Hierarchical clustering, Correlation clustering

Unit 8. **Brief overview of advanced techniques**

[4]

- Active learning
- Reinforcement learning
- Text mining
- Graphical models
- Web Mining

Reference Books:

1. Data Mining: Concepts and Techniques, Han, Elsevier ISBN:9789380931913/9788131205358
2. Margaret H. Dunham, S. Sridhar, Data Mining – Introductory and Advanced Topics, Pearson Education
3. Tom Mitchell, —Machine Learning]], McGraw-Hill, 1997
4. R.O. Duda, P.E. Hart, D.G. Stork. Pattern Classification. Second edition. John Wiley and Sons, 2000.
5. Christopher M. Bishop, —Pattern Recognition and Machine Learning]], Springer 2006
6. Raghu Ramkrishnan, Johannes Gehrke, Database Management Systems, Second Edition, McGraw Hill International
7. Ian H. Witten, Eibe Frank Data Mining: Practical Machine Learning Tools and Techniques, Elsevier/(Morgan Kauffman). ISBN:9789380501864
8. [Research-Papers]: Some of the relevant research papers that contain recent results and developments in data mining field

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Course Catalog for M. Sc. (Computer Science) Program

CS-204 Project

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 and demonstration.

You should fill your status of the project work on the progress report and get the Signature of project guide regularly. Progress report should sharply focus how much time you have spent on specific task. (The format of progress report is given as follow.) You should keep all signed progress report. Project will not be accepted if progress report is not submitted and all responsibility remains with student.

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Course Catalog for M. Sc. (Computer Science) Program

Project Progress Report

Roll No & Name of the student	
Title of the Project	
Project guide Name	

SN	From Date	To Date	Details of Project work	Project guide sign (with date)

Head,
Deptt. of Computer Science

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- You should prepare design document using SE/UML techniques depends on your project
- **Project Report Content should as follow :**
 1. College certificate
 2. Acknowledgement
 3. Problem Definition
 4. Existing System and need for the new system
 5. Scope of the work
 6. Feasibility study (Including H/W & S/W setup requirements)
 7. Requirement Analysis (including fact finding methods used)
 8. E-R diagrams
 9. Decision trees/Decision tables
 10. Normalized Database Design & Data Dictionary.
 11. Data flow Diagrams (if applicable)
 12. Use-case Diagrams
 13. Class Diagrams
 14. Object Diagrams
 15. Sequence Diagrams
 16. Collaboration Diagram
 17. Activity Diagram
 18. State Chart (if applicable)
 19. Component Diagram
 20. Deployment Diagram (if applicable)
 21. Use interface design
 - Menus
 - Input Screens using sample data
 - Reports, Graphs using sample data
 22. Testing & Implementation plan (Should contain testing strategies, techniques used & implementation approach used.)
 23. User manual

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Course Catalog for M. Sc. (Computer Science) Program

24. Drawbacks, Limitations & Proposed enhancement
25. Abbreviations used (if any)
26. Bibliography/Reference (Including book titles, authors name, editions, publications, etc)

About project Report: -

The report should be typed on A4 size, executive bond paper for the final submission. The report should be in the good quality Rexene bound. We suggest, using one-and-half spaced printing, Times New Roman 12 font sizes for the normal text, 14-16 font sizes for headings & page titles.

Number of copies:

For one project you should prepare 2 copies of the project report. One for yourself, one for college.

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Elective Course [CS-205]: Programming with DOT NET

Objectives:

- To understand the DOTNET framework, C# language features and Web development using ASP.NET

Prerequisites –

- Knowledge of object-oriented programming concepts such as data abstraction, encapsulation, inheritance, and polymorphism.
- Familiarity with programming language such as C++ and/or Java.
- Knowledge of web development

Topics to be covered:

Part I : C#

Unit 1. DOTNET Framework (2)

- Introduction to DOTNET
- DOT NET class framework
- Common Language Runtime
 - Overview
 - Elements of .NET application
 - Memory Management
 - Garbage Collector : Faster Memory allocation, Optimizations
- Common Language Integration
 - Common type system
 - Reflection API
- User and Program Interface

Unit 2. Introduction to C# (8)

- Language features
 - Variables and Expressions, type conversion
 - Flow Control
 - Functions, Delegates
 - Debugging and error handling, exception handling (System Defined and User Defined)
- Object Oriented Concepts
 - Defining classes, class members, Interfaces, properties
 - Access modifiers, Implementation of class, interface and properties
 - Concept of hiding base class methods, Overriding
 - Event Handling
- Collections, Comparisons and Conversions
 - Defining and using collections, Indexers, iterators
 - Type comparison, Value Comparison
 - Overloading Conversion operators, as operator
- Generics
 - Using generics
 - Defining Generics, generic Interfaces, Generic methods, Generic Delegate

Unit 3. Window Programming (6)

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

- a. Window Controls
 - i. Common Controls
 - ii. Container Controls
 - iii. Menus and Toolbars
 - iv. Printing
 - v. Dialogs
- b. Deploying Window Application
 - i. Deployment Overview
 - ii. Visual studio setup and Deployment project types
 - iii. Microsoft windows installer architecture
 - iv. Building the project : Installation

Unit 4. Data Access (6)

- a. File System Data
- b. XML
- c. Databases and ADO.NET
- d. Data Binding

Unit 5. Web Programming (6)

- a. Basic Web programming
- b. Advanced Web programming
- c. Web Services
- d. Deployment Web applications

Unit 6. .NET Assemblies (3)

- a. Components
- b. .NET Assembly features
- c. Structure of Assemblies
- d. Calling assemblies, private and shared assemblies

Unit 7. Networking (2)

- a. Networking overview
- b. Networking programming options
 - i. WebClient
 - ii. WebRequest and WebResponse
 - iii. TcpListener & TcpClient

Unit 8. Introduction to GDI+ (2)

- a. Overview of Graphical Drawing
- b. Pen Class, Brush Class, Font Class
- c. Using Images
- d. Clipping, Drawing2D, Imaging

Part II : ASP.NET

Unit 1. Introduction to ASP.NET (1)

Unit 2. Server Controls and Variables, control Structures & Functions (4)

- a. Forms, webpages, HTML forms, Webforms
- b. Request & Response in Non-ASP.NET pages
- c. Using ASP.NET Server Controls
- d. Datatypes : Numeric, text, arrays, datacollections
- e. Overview of Control structures
- f. Functions : web controls as parameters

Unit 3. Even Driven Programming and PostBack (3)

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

- a. HTML events
- b. ASP.NET page events
- c. ASP.NET Web control events
- d. Event driven programming and postback

Unit 4. Reading from Databases (3)

- a. Data pages
- b. ADO.NET

Unit 5. ASP.NET Server Controls (4)

- a. ASP.NET Web Controls
- b. HTML Server Controls
- c. Web Controls

Unit 6. DOTNET assemblies and Custom Controls (2)

- a. Introduction to Cookies, Sessions
- b. Session events
- c. State management Recommendations

Unit 7. Web Services (2)

- a. HTTP, XML & Web services
- b. SOAP
- c. Building ASP.NET web service
- d. Consuming a web service

Recommended Text and Reference books:

- Beginning Visual C#, Wrox Publication
- Professional Visual C#, Wrox Publication
- Inside C#, by Tom Archer ISBN: 0735612889 Microsoft Press © 2001, 403 pages
- Beginning ASP.NET 3.5, Wrox Publication
- Programming ASP.NET 3.5 by Jesse Liberty, Dan Maharry, Dan Hurwitz, O'Reilly
- Illustrated C# 2008, Solis, Publication APRESS, ISBN 978-81-8128-958-2
- Professional C# 4.0 and .NET 4 by Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, WROX
- Beginning C# Object-Oriented Programming By Dan Clark , Apress
- ADO.NET Examples and Best Practices for C# Programmers, By Peter D. Blackburn Apress
- Database Programming with C#, By Carsten Thomsen, Apress

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Elective Course [CS-206]: Artificial Intelligence

Prerequisites –

- Concepts of Data structures and Design and Analysis of algorithms

Objectives-

- To understand and gain the knowledge of the subject

Course contents –

Unit 1. Introduction to Artificial Intelligence

- What is AI?
- Early work in AI
- AI and related fields
- AI problems and Techniques

Unit 2. Problems, Problem Spaces and Search

- Defining AI problems as a State Space Search: example
- Production Systems
- Search and Control Strategies
- Problem Characteristics
- Issues in Design of Search Programs
- Additional Problems

Unit 3. Heuristic Search Techniques

- Generate-and-test
- Hill Climbing
- Best First Search
- Problem Reduction
- Constraint Satisfaction
- Mean-Ends Analysis

Unit 4. Knowledge Representation

- Representations and Mappings
- Approaches to Knowledge Representation
- Knowledge representation method
- Propositional Logic
- Predicate logic
- Representing Simple facts in Logic
- Representing Instances and Isa relationships
- Computable Functions and Predicates
- Resolution
- Forward and backward chaining

Unit 5. Slot – and – Filler Structures

- Weak Structures
- Semantic Networks
- Frames
- Strong Structures
- Conceptual Dependencies
- Scripts

Unit 6. Game Playing

- Minimax Search Procedures
- Adding alpha-beta cutoffs
- Uncertainty Reasoning: Basic Probability Axioms, Baye's

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Rule, Bayesian Classification, Certainty Factor Theory, Dempster Shafar Theory.

Unit 7. Learning

- What is learning?
- Rote Learning
- Learning by taking advice
- Learning in problem solving
- Learning from examples
- Explanation based learning

Internal evaluation

- To implement the AI concepts using programming language PROLOG.

Reference books –

1. Computational Intelligence, Eberhart, Elsevier, ISBN 9788131217832
2. Artificial Intelligence: A New Synthesis, Nilsson, Elsevier, ISBN 9788181471901
3. Artificial Intelligence, Tata McGraw Hill, 2nd Edition, by Elaine Rich and Kevin Knight
4. Introduction to Artificial Intelligence and Expert System, Prentice Hall of India Pvt. Ltd., New Delhi, 1997, 2nd Printing, by Dan Patterson.

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Elective Course [CS-207]: Advance Algorithms

Unit 1 : Advanced data structures (Fibonacci heaps, splay trees, dynamic trees, B-Trees) in-memory representations and persistence of DS, Revision of Graph algorithms: Network flows (max flow and min-cost flow/circulation) (10 Hrs)

Unit 2 . String algorithms: (10 Hrs)

- 1 String searching - (Knuth–Morris–Pratt algorithm, Boyer–Moore string search algorithm, Rabin–Karp string search algorithm)
2. Suffix trees - mathematical properties of suffix trees
3. Applications of Suffix trees:
Regular expression searches using suffix trees;
Finding all maximal pairs and maximal repeats, Patricia trees

Unit 3 : Intractable problems: approximation algorithms (14 Hrs)

1. Steiner tree and TSP
2. Steiner forest
3. Group Steiner trees
4. Set cover via primal-dual
5. k-median on a cycle

Unit 4: Integer programming and optimization algorithms (14 Hrs.)

1. Formulations, complexity and relaxations
2. discrete optimization,
3. cutting plane methods,
4. enumerative and heuristic methods
5. Convex programming algorithms: ellipsoid method, interior-point methods, proximal point methods.

Preliminary reading:

- Introduction to Algorithms: by Cormen, T.H., C.E. Leiserson, R.L. Rivest, and C. Stein; MIT Press; ISBN: 9780262032933
- The Algorithm Manual, Steven Skiena, Springer ISBN:9788184898651

Reference Books:

- Theory of Linear and Integer Programming: by Schrijver; John Wiley & Sons. ISBN: 9780471982326
- Convex Optimization: by Boyd and Vandenberghe; Cambridge University Press; ISBN: 9780521833783
- Approximation Algorithms: by Vazirani; Springer-Verlag: ISBN: 9783540653677
- Advances in Steiner Trees (Combinatorial Optimization) by Ding-Zhu Du (Editor), J.M. Smith (Editor), J. Hyam Rubinstein (Editor); Springer; ISBN: 978-0792361107
- Algorithms On Strings, Trees, And Sequences; by D. Gusfield; Cambridge University Press,(ISBN 052158519)

Additional reading:

- Algorithmic Number Theory: by Bach and Shallit; MIT Press; ISBN: 9780262024051

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Course Catalog for M. Sc. (Computer Science) Program

Syllabus of S. Y. M. Sc. (Computer Science)

2012-13

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Proposed Syllabus for M.Sc. (Computer Science) Semester 3 and Semester 4
(Affiliated Colleges to University of Pune)

To be implemented from Academic year 2012-2013

Semester 3

CS-301(NEW): Software Metrics & Project Management

CS-302(NEW): Mobile Computing

CS-303(NEW): Soft Computing

CS-304(NEW): Elective Course (Departmental)

CS-305(NEW): Laboratory course (Departmental)

Semester 4

CS-401(NEW): Full Time "Industrial Training Project"

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Course Catalog for M. Sc. (Computer Science) Program

CS-301(NEW): Software Metrics & Project Management

1. What is a Project? What is Project management? Project phases and project life cycle, organizational structure, Qualities of Project Manager. [4]
2. Project Management Components. Project Integration Management-Project plan development and execution, change controls, configuration management. [6]
3. Scope Management-Strategic planning ,scope planning, definition ,verification and control. [4]
4. Time management- Activity planning, schedule development and control. [2]
5. Cost Management- Cost estimation and Control. [2]
6. Quality Management- Quality planning and assurance. [2]
7. Human Resource Management- Organizational planning, staff acquisition. [2]
8. Communication Management-Information distribution , reporting. [2]
9. Risk Management-Risk identification, Quantification and control. [2]
10. Procurement Management- Solicitation, contract administration. [2]
11. Software Metrics- The scope of software metrics, software metrics data collection, analyzing software data, measuring size, structure, external attributes. [6]
12. Software Reliability- Measurement and prediction, resource measurement, productivity, teams and tools. [6]
13. Planning a measurement program. What is metrics plan?: Developing goals, questions and metrics. Where and When: Mapping measures to activities. How: Measurement tools. Who: Measurers, analyst, tools revision plans. [4]
14. Quality Standards – CMM, PSP/TSP [4]

References

1. Information Technology Project Management, 6th Edition Kathy Schwalbe ISBN-13: 9781111221751 , Cenage Learning
2. Software Metrics: A rigorous and Practical Approach by Norman E. Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press
3. Software Engineering: A Practioner's Approach by Roger S. Pressman ISBN: 9780071267823
4. Practical Software Metrics for Project Management and Process Improvement Robert B. Grady, Prentice hall, ISBN : 9780137203840

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-302(NEW): MOBILE COMPUTING

Prerequisites

- Concepts of Data communication
- Concepts of Networking
- Conversant with OS internals
- Java programming
- Brief History of wireless communication

Objectives

- ❖ To familiarize the students with the technology behind mobile communication
- ❖ Understand the GSM architecture and services provided
- ❖ Understand the issues relating to Wireless mobile applications
- ❖ Understand the architecture of J2ME and Android Operating System.
- ❖ Develop simple mobile applications.

1. Introduction to Mobile Computing

Lectures 2

- i. Introduction and need for Mobile computing
- ii. Mobility and portability
- iii. Mobile and Wireless devices
- iv. Applications
- v. Brief History of wireless communication

- *Mobile Comm. By Jochen Schiller*

2. Wireless Transmission

Lectures 3

- i. General Concepts of multiplexing and modulation
- ii. Spread Spectrum
- iii. Cellular Systems

- *Mobile Comm. By Jochen Schiller*

3. Medium Access Control Layer

Lectures 4

- i. Why specialized MAC?
 - a. hidden and exposed terminals
 - b. near and far terminals
- ii. General Concepts and comparison of SDMA, FDMA, TDMA, CDMA

- *Mobile Comm. By Jochen Sciller*

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

4. Mobile IP **Lectures 9**

- i. Goals, assumptions and requirements
- ii. Entities and terminologies
- iii. Agent Discovery
- iv. Registration
- v. Tunneling and encapsulation
- vi. Reverse Tunneling
- vii. IPv6
- viii. IP micro-mobility support – Cellular IP, Hawaii, Hierarchical, mobile IPv6
- ix. Mobile Routing :
 - Destination sequence distance Vector, Dynamic Source Routing,
 - Alternative Metrics, Adhoc Routing Protocols -Flat, Hierarchical,
 - Geographic-position-assisted

- *Mobile Comm. By Jochen Schiller*

5. Mobile TCP **Lectures 5**

- i. Traditional TCP
 - Congestion Control, Slow start, Fast retransmit / Fast recovery
 - Implications on mobility
- ii. Classical TCP improvements
 - Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit / Fast recovery, Transmission / Timeout freezing, Selective Retransmission, Transaction oriented TCP
- iii. TCP over 2.5/3G wireless networks

- *Mobile Communications By Jochen Schiller*

6. GSM **Lectures 9**

- i. Mobile Services (Bearer, Tele-and-supplementary services)
- ii. System Architecture
 - Radio subsystem
 - Network and switching subsystem
 - Operation subsystem
- iii. Protocols
 - Localization and calling
 - Handover
- iv. Value Added Services
 - SMS: Architecture, Mobile Originated and Mobile Terminated procedures
 - Cell Broadcast Service: Architecture, Message Transfer Procedure
 - MMS: Architecture, Protocol framework, Message Transfer Procedure
 - Location Services: Logical Reference Model, Control Procedures, Network Architecture, determination of Location Information, Location based services
- v. GPRS

- *Mobile Communication. By Jochen Schiller*
- *2G Mobile Networks: GSM and HSCSD By Nishit Narang and Sumit Kasera*

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

- 7. Introduction to 3G mobile networks** **Lectures 4**
- i. UMTS
 - System architecture, radio interface(Pg 163,164)
 - ii. UTRAN
 - Architecture, Functions of RNC, Core network
 - iii. Handover
 - Hard and soft handover

• *Mobile Communication. By Jochen Schiller*

- 8. Wireless Application Protocol** **Lectures: 6**
- i. Architecture
 - ii. Wireless datagram protocol
 - iii. Wireless transport layer security
 - iv. Wireless transaction protocol
 - v. Wireless session protocol
 - vi. Wireless application environment
 - vii. WAP Push Architecture, protocols

• *Mobile Communications by Jochen Schiller*

- 9. Introduction to J2ME** **Lectures 3**
- i. J2ME Architecture
 - ii. CLDC, CDC
 - iii. J2ME Profiles
 - iv. MIDlets, lifecycle of MIDlet
 - v. Simple J2ME MIDlet.

Any J2ME book / online resources

- 10. Introduction to Android Operating System** **Lectures 3**
- i. Overview and evolution of Android
 - ii. Features of Android
 - iii. Android architecture
 - iv. Components of an Android Application, Manifest file
 - v. Android Activity and Service Lifecycle

Any Android book / online resources

Reference Books

1. Learning Android Game Programming: A Hands-On Guide to Building Your First Android Game by Rick Rogers, addison-wesley professional, ISBN: 9780321769626
2. Mobile Communications Jochen Schiller, Pearson Education, 2nd Edition, ISBN : 9780321123817

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

3. Pervasive Computing: Technology and Architecture of Mobile Internet Applications- Jochen Burkhardt, Dr. Horst Henn, Steffen Hepper, Klaus Rintdorff, Thomas Schack , Pearson Education ISBN 9788177582802
4. Beginning Android Application Development by Wei-Meng Lee Wiley India ISBN:9788126531066
5. Mobile Computing: Implementing Pervasive Information and Communications Technologies by Shambhu Upadhyaya, Kevin Kwiat, Abhijit Chaudhury, Springer ISBN:9781402071379
6. Wireless Java Programming with J2ME - Yu Feng and Dr, Jun Zhu , Techmedia Publications, 1st edition
7. Complete Reference J2ME . by James Keogh ISBN: 978-0072227109
8. Mobile Networks GSM and HSCSD- Nishit Narang, Sumit Kasera, TataMcGrawHill
9. Mobile Computing: Technology, Applications, and Service Creation by Asoke K. Talukder, Roopa R. Yavagal, ISBN : 9780071477338
10. Beginning Android 3 by Mark Murphy APress , ISBN 9788132203568
11. Beginning Android - Mark Murphy, Apress ISBN 9781430224198
12. Android Application Development: Programming with the Google SDK by Rick Rogers, John Lombardo, Zigurd Mednieks, O'reilly media ISBN:9780596521479
13. The Android Developer's Cookbook: Building Applications with the Android SDK by James Steele, Nelson To, Addison-wesley professional, ISBN: 9780321741233
14. Beginning Android Application Development by Wei-Meng Lee, Wiley India pvt ltd, ISBN:9788126531066
15. The Android Developers Guide [<http://developer.android.com/guide/index.html>]

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-303(NEW): Soft Computing

Objective: To understand the concepts of how an intelligent system work and its brief development process

Description: Intelligent systems can function as intelligent assistants, augmenting or supplementing human expertise while increasing productivity. This course exposes learners to Neural Network, Fuzzy Logic and Genetic Algorithms, which are the major building blocks of Intelligent Systems.

1. **Classical Sets and Fuzzy Sets and Fuzzy relations** [5]
Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations.
2. **Membership functions** [4]
Features of membership functions, standard forms and boundaries, fuzzification, Inference
3. **Fuzzy to Crisp conversions** [4]
Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods,
4. **Classical Logic and Fuzzy Logic** [3]
Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication
5. **Fuzzy Rule based Systems** [4]
Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System with MATLAB,
6. **Applications of Fuzzy Logic** [3]
How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting
7. **Introduction to Neural Networks** [4]
Advent of Modern Neuroscience, Classical AI and Neural Networks, Hybrid Intelligent Systems, Biological Neurons
8. **Artificial Neurons, Neural Networks and Architectures** [4]
Neuron abstraction, Neuron signal functions, Architectures: feedforward and feedback Salient properties and application domains
9. **Perceptrons and LMS** [8]
Learning and memory, From synapses to behaviour : The case of Aplysia, Learning Algorithms, Error correction and gradient descent rules, The learning objectives for TLNs, Pattern space and weight space, Perceptron learning algorithm, Perceptron convergence algorithm, Perceptron learning and Non-separable sets, alpha-Least Mean Square Learning, MSE Error Surface and its Geometry, Steepest Descent Search with Exact Gradient Information, Mue-LMS: Approximate Gradient Descent, Backpropagation Learning algorithm
10. **Applications of Neural Networks** [3]
Pattern Recognition and classification

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

11. **Genetic Algorithms (GA)** [4]
Introduction to GA. Robustness of Traditional Optimization and search methods. How are Genetic Algorithms different from Traditional Methods?
12. **Applications of Genetic Algorithm** [4]
GA based clustering Algorithm, Image processing and pattern Recognition

Reference Books

- Principles Of Soft Computing (With CD)by S. N. Sivanandam,S. N. Deepa, Wiley india, ISBN:9788126527410
- Fuzzy Logic: With Engineering Applications by Timothy J Ross, Wiley India, ISBN:9788126513376
- Neural Networks: A Classroom Approach,1/e by Kumar Satish, TMH, ISBN:9780070482920
- Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson Education, ISBN:9788177588293
- AN INTRODUCTION TO FUZZY LOGIC AND FUZZY SETS by Buckley James J., Springer ISBN:9788181287878
- Neural Networks: An Introduction by Berndt Muller, B. Muller, Springer, ISBN: 9783540602071
- Introduction to Genetic Algorithms by S. N. Sivanandam, S. N. Deepa. Springer, ISBN: 9783540731894

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-304(New): Elective Course

Please note that, one elective from the following list to be opted for each of the semesters 2nd and 3rd (CS-204 in semester two and CS-304 in semester three respectively) according to prerequisite conditions (if any).

List of Elective Courses

1. Advanced Algorithms
2. Functional Programming
3. Linux Kernel Programming and Introduction to Device Drivers
4. Natural Language Processing
5. Program Analysis
6. DOT NET
7. Information Systems Security
8. Software Architecture and Design Patterns
9. Software Testing Tools & Methodologies
10. Modeling and Simulations
11. Embedded System Programming
12. Language Processors
13. Artificial Intelligence

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-305(NEW): Lab Course (Departmental)

Distribution of Marks for Assignments

Course Code	Paper Title	Marks
CS-301(NEW)	Software Metrics & Project Management	10
CS-302(NEW)	Mobile Computing	15
CS-303(NEW)	Soft Computing	15
CS-304(NEW)	Elective Course(Departmental)	10
Total Marks		50

➤ **Project for 50 Marks**

Student can undertake a project on any platform using any technology. However, if a student chooses to use mobile technology then the following guidelines are to be used.

It is expected (not compulsory) that M.Sc. Sem III students will to do a project in Mobile Computing so that they will have enough hands on experience of programming under mobile computing environment . If a student wishes to do so, the project may to be done in J2ME and the student is expected to use following features of J2ME:

- ❖ Persistent storage
- ❖ Networking (if required)
- ❖ Messaging APIs (if required)
- ❖ Web Server (if required)
- ❖ Email Servers

List of Projects for Reference:

1. Tax calculation and planning by considering all possible investment options and special relaxations
2. Marathi Calendar/Calendar with all religious and festival events etc. (Standard English Calendar is not allowed)
3. General Planner
4. Personal Insurance Planner (policy details with remainders for premiums)
5. Small text file editor
6. Mobile chatting (using chat server running on normal PC)

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

7. Group chatting using Bluetooth (without server)
8. Games (single player/multiplayer)
9. Application to operate PPT presentation using mobile phone
10. Mobile phone based attendance system
11. Uploading/Downloading contact list from email server such as gmail.com, rediffmail.com etc.
12. Downloading notices, list of assignments, exam schedule on mobile phone of student using server present in college laboratory.

NOTE: Please discuss feasibility of mobile application with your guide before choosing a topic. To develop and test mobile applications appropriate resources must be available. College will only provide PC and if possible mobile phones. Students have to arrange for additional resources as per the requirements of their Project

➤ Assignments

15+15+15 marks respectively for the University courses (CS-301(NEW), CS-302(NEW), CS-303(NEW)) and 5 marks for an active participation in the seminar by an expert on emerging technologies

Assignments on CS-301(NEW)

Any two aspects of an application system from the following list should be carried out by the student as his assignment for 15 marks

- Description of the system (covering major inputs, outputs, overall activity flow of the system etc.)
- Project Charter
- Scope Statement
- Work Breakdown Structure (upto level 3)
- Cost Appropriation Structure
- Overall Time Schedule
- Role of Project Manager in that specific System
- Roles & Responsibility Matrix Preparation

The above assignment can be on any one application system. The sample list of the same is as follows.

- Library System (College Library or Public Library)
- College Admission System
- College/University Examination System
- Sales System

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

- Purchase System
- Production Management System
- Inventory System
- Recruitment System of a Company
- Salary Processing System
- Transaction Processing System in organizations like banks, LIC, Financial Institutions etc.
- Any Specific Events Management System (like IPL tournament, Cricket/football World Cup etc, Adhar Card issuing system)
- Local Transport Route Scheduling System

Assignments on CS-302(NEW)

Implementation guidelines

- Every student should do **at least one** assignment for this subject, either using J2ME or Android.
- The assignment should be done individually.
- The total weightage for the assignment is **15 marks**.

Sample list of Assignments:

1. Create TODO list with alarm functionality
2. Appointment / event scheduler
3. Timetable manager with alerts
4. Simple calculator
5. Secure sms
6. Secure phonebook
7. Mobile Dictionary
8. Information retrieval Applications : Stock quotes, Cricket score, daily horoscope etc.
9. Games (word games, puzzles, tic-tac-toe, Sudoku etc.)
10. Mobile Quiz
11. Personal expense manager
12. Barcode reader
13. Vehicle details and average/mileage calculation app.
14. Secure Password and Account information manager
15. Music player application with play, pause and resume functionality.
16. Image viewer to list and view the images.
17. Video Player application to play MPEG files.
18. Integration with Google Apps: Google Maps, Docs, Calender etc.
19. Simple Applications using GPS
20. Datebook with important dates, birthdays, holidays, events etc.
21. Create Stopwatch app with the timer functionality.

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

22. Unit Converter Apps
23. Body Mass Index Application
24. Recipe App with facilities to list, view, add/delete recipes
25. Google map application with the facility to show important cities Annotation on Map.
26. Facebook App to share text, images on user's Wall.
27. Twitter App to tweet from your phone.
28. Interfacing apps to control electronic circuits (ex: temperature controller from mobile device, LED/LCD display)
29. PC-Mobile Communication Apps (Desktop viewer, LAN management, PC Hardware-Software information, LAN user list retriever, PC controlling etc.)
30. Bluetooth based applications: sending message, files etc.

Assignments on CS-303(NEW)

Fuzzy Logic Assignments on following topics :

Max-Min Composition, Max Product Composition, Zadeh's extension principle, Linguistic Hedges, Alpha Cut

Solve the following and write software –programs for the above methods.

Assignment No. 303_FL_1

The task of identifying images in an overhead reconnaissance photograph is imprecise. You are now ready to design computer software to do image processing to locate objects within a scene. Define two fuzzy sets representing a car and a truck image.

Fuzzy set for Car = 0.5/truck + 0.4/motorcycle + 0.3/boat + 0.9/car + 0.9/house

Fuzzy set for Truck = 1/truck + 0.1/motorcycle + 0.4/boat + 0.4/car + 0.2/house

Find the following:

- a) $\text{Car} \cap \text{Truck}$
- b) $\text{Car} \cup \text{Truck}$

Assignment No. 303_FL_2

We need a circuit that can detect the AC line frequency, to determine whether the camera should implement the European PAL, video standard (for 50 –Hz systems) or the U.S NTSC video standard (for 60 Hz systems)

Fuzzy set A is "about 60 Hz" and Fuzzy set B is "about 50 Hz".

The universe for both of these variables – 0 to infinite frequency. Continuous, triangular membership function to be used, symmetric about the prototypical value.

A has a prototypical value of 60Hz

B has a prototypical value of 50Hz

Base width for both fuzzy set A and B 16 Hz

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Course Catalog for M. Sc. (Computer Science) Program

$$\begin{array}{l} \text{For fuzzy set A,} \\ \text{For fuzzy set B,} \end{array} \quad \begin{array}{l} \mu_A(x) = |60-x| / 8 + 1 \\ \mu_B(x) = |50-x| / 8 + 1 \end{array}$$

Assignment No. 303_FL_3

There are four groups of M.Sc. students at the University. A fuzzy tolerance relation R is produced by the domain experts according to the level of academic preparations of these students. If α cut levels and find classes into which these four groups can be classified.

$$\text{Fuzzy R} = \begin{array}{cccc} & 1 & 0.8 & 0.3 & 0.7 \\ & 0.8 & 1 & 0.9 & 0.1 \\ & 0.3 & 0.9 & 1 & 0.6 \\ & 0.7 & 0.1 & 0.6 & 1 \end{array}$$

[Explain the procedure clearly and assumptions made, if any]

Assignment No. 303_FL_4

The relationship between temperature and maximum operating Frequency R depends on various factors for given electronic circuit. Let Fuzzy T be a temperature fuzzy set (in degrees Fahrenheit) and Fuzzy F represent a frequency fuzzy set (in MHz) on the following universe of discourse:

$$T = \{-100, -50, 0, 50, 100\} \text{ and } F = \{8, 16, 25, 33\}$$

Suppose a Cartesian product between Fuzzy T and Fuzzy F is formed that results in the following relation.

$$R = \begin{array}{cccccc} & -100 & -50 & 0 & 50 & 100 \\ & 8 & 0.2 & 0.5 & 0.7 & 1 & 0.9 \\ & 16 & 0.3 & 0.5 & 0.7 & 1 & 0.8 \\ & 25 & 0.4 & 0.6 & 0.8 & 0.9 & 0.4 \\ & 33 & 0.9 & 1 & 0.8 & 0.6 & 0.4 \end{array}$$

The reliability of the electronic circuit is related to the maximum operating temperature. Such a relation S can be expressed as a Cartesian product between the reliability index $M = \{1, 2, 4, 8, 16\}$ (in dimensionless units) and the temperature, as in the following example.

$$S = \begin{array}{cccccc} & & 1 & 2 & 4 & 8 & 16 \\ & -100 & 1 & 0.8 & 0.6 & 0.3 & 0.1 \\ & -50 & 0.7 & 1 & 0.7 & 0.5 & 0.4 \\ & 0 & 0.5 & 0.6 & 1 & 0.8 & 0.8 \\ & 50 & 0.3 & 0.4 & 0.6 & 1 & 0.9 \\ & 100 & 0.9 & 0.3 & 0.5 & 0.7 & 1 \end{array}$$

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Composition can be performed on any two or more relations with compatible row column consistency. To find a relationship between frequency and the reliability index, use Max- min composition and Max –product composition

Assignment No. 303_FL_5

Consider the following function:

$$Y = f(x) = (x - 3)^2 = x^2 - 6x + 11$$

The fuzzy integer number Around A for X universe is given as below:

Around A = $\{0.3/2 + 0.6/3 + 1/4 + 0.6/5 + 0.3/6\}$ where + denotes union. Explain and apply Zadeh's extension principle.

Assignment No. 303_FL_6

In the field of computer networking there is an imprecise relationship between the level of use of a network communication bandwidth and the latency experienced in peer – to – peer communications. Let X be a fuzzy set of use levels (in terms of the percentage of full band width used) and Y be a fuzzy set of latencies (in milliseconds)

$$X = \{0.2 / 10 + 0.5 / 20 + 0.8 / 40 + 1.0 / 60 + 0.6 / 80 + 0.1 / 100\}$$

$$Y = \{0.3/ 0.5 + 0.6 / 1 + 0.9 / 1.5 + 1.0 / 4 + 0.6 / 8 + 0.3 / 20\}$$

You have been given a second fuzzy set of bandwidth usage -

$$Z = \{0.3 / 10 + 0.6 / 20 + 0.7 / 40 + 0.9 / 60 + 1 / 80 + 0.5 / 100\}$$

Compute Max-Min Composition

Compute Max-Product

Assignment No. 303_FL_7

A certain Software Developer Test his products for User friendliness by trying their programs out on new users. The test participants are given a user manual and asked to perform a task with the software. Meanwhile the developer watches the Users reaction as they use the software. The developer keeps a record of each User's Performance. Counting the number of times each User looks at the manual and recording each Users opinion of how User friendly the software was. The developer then creates two fuzzy variables, User friendly and easy to learn relating the User's reactions to how many times they had to look at the manual

$$\text{User friendly} = \{1/0 + 0.8/1 + 0.65/2 + 0.4/3 + 0.15/4 + 0.05/5\}$$

$$\text{Easy to Learn} = \{1/0 + 0.9/1 + 0.75/2 + 0.6/3 + 0.3/4 + 0.1/5\}$$

On the basis of the Observation find the Membership functions for the following User friendly but not very User friendly User friendly or easy to learn

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Neural Network Assignments (On Perceptron)

Assignment No. 303_NN_1: Create a 2-class problem on 2-dimensional data. Generate 500 examples (approximately equal number for each class) with attributes from [0,1]. Plot the data points

Assignment No. 303_NN_2: Create a NN to classify some data into one of two classes E.g: Classify Soft drinks produced by certain Companies as 'Good' or 'Bad' based on certain attributes Like – taste, effervesce, mouth feel, color

Genetic Algorithms Assignment (On Crossover and Mutation)

Assignment No. 303_GA_1: The Knapsack Problem

The goal of this assignment is to write a genetic algorithm that solves the Knapsack Problem. Briefly stated, the Knapsack Problem goes like this: You have a collection of N objects of different weights, w_1, w_2, \dots, w_n , and different values, v_1, v_2, \dots, v_n , and a knapsack that can only hold a certain maximum combined weight W. You would like to get a set of objects of maximal value into the knapsack. As a search problem, the knapsack problem turns out to be intractable – there is no way to search that is efficient, reducing the search to an exhaustive check of all possible combinations of objects, and the time to solve it grows exponentially with the number of objects. As a genetic algorithm, however, solutions that come extremely close to the maximum, while not guaranteed to actually be the maximum, can be found very quickly.

Write a GENETIC ALGORITHM that solves the Knapsack problem with parameters: (knapsack NumIterations ObjectList MaxWeight PopulationSize MutationPct)

Your program will start by creating PopulationSize random members of the population (including a computation of the fitness function for each one). It will then loop iteratively NumIterations times, performing the following functions:

- Randomly select a pair of parents to breed
- Pick a random spot for crossover, and breed two new children (with fitness computed)
- Randomly decide whether to mutate based on MutationPct, and if so, mutate one gene
- Kill off the two weakest members of the population, to keep the size constant

The genome can be simply a list of 1's and 0's, indicating whether each element of ObjectList either is or is not in the knapsack. Store the fitness value. The fitness function is the total value of the objects in the knapsack, unless the weight of the objects would be higher than MaxWeight, in which case the fitness is 0 (or at any rate, smaller than any legitimate non-overweight knapsack). Typically the overweight knapsacks will disappear from your population very quickly). Your program should end by reporting the best remaining member of the population at the end of the run, along with the actual weight and value of that member.

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Example:

Name	Weight	Value
A	45	3
B	40	5
C	50	8
D	90	10

And a knapsack can support a maximum weight of 100 pounds.

Let a genome be a pair showing the fitness value and then a list of 0's and 1's showing whether each item is in the knapsack. Some of the genomes that can be randomly generated along with their fitness values:

(3 (1 0 0 0)) [A is in the knapsack; total value is 3]

(8 (1 1 0 0)) [A and B are in the knapsack; total value is 8]

(0 (1 1 1 1)) [A, B, C, and D are all in; fitness value is 0 because the bag is overweight.]

If the first and third is picked to cross over, and if we randomly cross them over starting at the third item, your two new child genomes would be

(0 (1 0 1 1)) and (8 (1 1 0 0))

If we then randomly chose to mutate the last gene of the first child, it would turn into (11 (1 0 1 0)) [A and C are in the knapsack; total value is 11] at which point, if the maximum population size was 3, we would kill off the members valued at 0 and 3, keeping the other three (even though two of them are the same). Then repeat the breeding, mutation, and death cycle until you had gone through the specified number of iterations.

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Semester – IV

CS-401(NEW): Full Time 'Industrial Training Project' (ITP)

Period – Minimum 4 months

0. There will be a teacher coordinator for a group of students. A teacher coordinator will take care of joining letters from students along with other necessary submission listed below.
1. A student will have to submit 2 reports during the period of ITP to the Department of the college.
2. After the completion of the ITP, a student will have to submit a synopsis along with the project completion certificate from the respective industry/research institute /educational institute.
3. A student will submit one hard copy (Student Copy) and a soft copy's (preferably 2 CDs) of the work carried out towards ITP.
4. The project will be graded by the experts (One internal examiner, one external examiner(academic expert) and one industrial expert) as follows:

O – 75 and above	C– 50 and above	F- A student will have to carry out project once again for a complete semester
A – 65 and above	D– 45 and above	
B – 55 and above	E– 40 and above	

Important Note: A student can complete ITP with a research project of a teacher / an expert funded by the University of Pune/ a funding agency.

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Course Catalog for M. Sc. (Computer Science) Program

Syllabus of S.Y. M.Sc. (Computer Science) Course

Academic Year 2014-15

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Course Catalog for M. Sc. (Computer Science) Program

Syllabus for M.Sc. (Computer Science) in affiliated colleges to University of Pune

(To be implemented from Academic year 2014-2015)

Credit Based System

Year/ Semester	Subject	Paper	Title of Paper	Hours/ Week	Credit	% of Assessment		
						IA	UE	Total
II Year Sem-III	Core	CS-301	Software Metrics & Project Management	4	5	50	50	100
	Core	CS-302	Mobile Computing	4	5	50	50	100
	Core	CS-303	Soft Computing	4	5	50	50	100
	Elective	CS-304	Project	4	5	50	50	100
	Elective	CS-305	Web Services	4	5	50	50	100
	Elective	CS-306	Database and System Administration	4	5	50	50	100
	Elective	CS-307	Functional Programming	4	5	50	50	100
	Elective	CS-308	Business Intelligence	4	5	50	50	100

Minimum Credit : 25, Maximum Credit : 35 Core Subject is compulsory, From elective courses student can select two course for minimum credit and four 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	CS-401	Industrial Training /Institutional project	-	15	50	50	100
	Elective	CS-402	Parallel Computing	4	5	50	50	100
	Elective	CS-403	Embedded System	4	5	50	50	100
	Elective	CS-404	Software Quality Assurance	4	5	50	50	100
	Elective	CS-405	Modeling and Simulation	4	5	50	50	100

Core Subject is compulsory. If student had completed 85 credit within three semesters then no need to select any elective course otherwise student should select appropriate number of elective courses to minimum complete 100 credits.

IA :- Internal Assessment, UE :- University Examination

M.Sc (Computer Science)

Part - II / Semester 3

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(CORE) CS 301: Software Metrics & Project Management

No of lectures: 48

Pre-requisites

- Software Engineering
- Basic testing concepts

Objectives

- Software Metrics and Project Management covers skills that are required to ensure successful medium and large scale software projects.
- It examines Requirements Elicitation, Project Management, Verification and Validation and Management of Large Software Engineering Projects.
- Student learn to select and apply project management techniques for process modeling, planning, estimation, process metrics and risk management; perform software verification and validation using inspections, design and execution of system test cases.

Chapter 1 : Introduction to Project Management [4]

- What is a Project?
- What is Project management?
- Project phases and project life cycle
- Organizational structure
- Qualities of Project Manager

Chapter 2 : Project Management Components [6]

- Project Integration Management-Project plan development and execution
- Change controls
- Configuration management

Chapter 3 : Scope Management [4]

- Strategic planning
- Scope planning, definition
- Verification and control

Chapter 4 : Time management [2]

- Activity planning
- Schedule development and control

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Chapter 5 : Cost Management	[2]
• Cost estimation and Control	
Chapter 6 : Quality Management	[2]
• Quality planning and assurance	
Chapter 7 : Human Resource Management	[2]
• Organizational planning	
• Staff acquisition	
Chapter 8 : Communication Management	[2]
• Information distribution	
• Reporting	
Chapter 9 : Risk Management	[2]
• Risk identification	
• Quantification and control	
Chapter 10 : Procurement Management	[2]
• Solicitation	
• Contract administration	
Chapter 11 : Software Metrics	[6]
• The scope of software metrics	
• Software metrics data collection	
• Analyzing software data	
• Measuring size, structure, external attributes	
Chapter 12 : Software Reliability	[6]
• Measurement and prediction	
• Resource measurement	
• Productivity, teams and tools	
Chapter 13 : Planning a measurement program	[4]
• What is metrics plan?	
• Developing goals, questions and metrics	

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

- Where and When: Mapping measures to activities
- How: Measurement tools
- Who: Measurers , analyst, tools revision plans

Chapter 14 : Quality Standards

[4]

- CMM
- PSP/TSP

Reference Books

1. Information Technology Project Management, 6th Edition Kathy Schwalbe ISBN-13 :9781111221751 , Cenage Learning
2. Software Metrics: A rigorous and Practical Approach by Norman E. Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press
3. Software Engineering: A Practioner's Approach by Roger S. Pressman ISBN: 9780071267823
4. Practical Software Metrics for Project Management and Process Improvement Robert B. Grady, Prentice hall, ISBN : 9780137203840

Note: -

- Numerical should be covered on Cost Management (COCOMO), Time Management.
- For Internal Evaluation group-wise case study is compulsory.

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(CORE) CS 302: Mobile Computing

No of Lectures: 48

Prerequisites

- Concepts of multiplexing and modulation
- Concepts of Networking
- Conversant with OS internals
- Familiar with event handling
- Web browsers
- Create and Compile Java Programs
- Brief History of wireless communication

Objectives

- To familiarize the students with the buzz words and technology of mobile communication
- Understand the GSM architecture
- Understand the issues relating to Wireless applications

Chapter 1 : Introduction to Mobile Computing [2]

- Introduction and need for Mobile computing
- Mobility and portability
- Mobile and Wireless devices
- Applications
- Brief History of wireless communication

Chapter 2 : Wireless Transmission [3]

- General Concepts of multiplexing and modulation
- Spread Spectrum
- Cellular Systems

Chapter 3 : Medium Access Control Layer [4]

- Why specialized MAC?
 - a. hidden and exposed terminals
 - b. near and far terminals
- ii. General Concepts and comparison of SDMA, FDMA, TDMA , CDMA

Chapter 4 : Mobile IP [8]

- Goals, assumptions and requirements
- Entities and terminologies
- Agent Discovery
- Registration

- Tunneling and encapsulation

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

- Optimization
- Reverse Tunneling
- IPv6
- IP micro-mobility support – Cellular IP, Hawaii, Hierarchical, mobile IPv6
- Mobile Routing :
 - Destination sequence distance Vector, Dynamic Source Routing,
 - Alternative Metrics, Adhoc Routing Protocols -Flat, Hierarchical,
 - Geographic-position-assisted

Chapter 5 : Mobile TCP

[5]

- Traditional TCP
 - Congestion Control, Slow start, Fast retransmit / Fast recovery
 - Implications on mobility
- Classical TCP improvements
 - Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit / Fast recovery, Transmission / Timeout freezing, Selective Retransmission, Transaction oriented TCP
- TCP over 2.5/3G wireless networks

Chapter 6 : GSM

[8]

- Mobile Services (Bearer, Tele-and-supplementary services)
- System Architecture
 - Radio subsystem
 - Network and switching subsystem
 - Operation subsystem
- Protocols
- Localization and calling
- Handover
- Value Added Services
 - SMS: Architecture, Mobile Originated and Mobile Terminated procedures
 - Cell Broadcast Service: Architecture, Message Transfer Procedure
 - MMS: Architecture, Protocol framework, Message Transfer Procedure
 - Location Services: Logical Reference Model, Control Procedures, Network Architecture, determination of Location Information, Location based services
- GPRS

Chapter 7 : 3G mobile networks

[8]

- UMTS
 - System architecture, radio interface
- UTRAN
 - Architecture, Functions of RNC, Core network
- Handover
 - Hard and soft handover

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Chapter 8 : Wireless Application Protocol [4]

- Architecture
- Wireless datagram protocol
- Wireless transport layer security
- Wireless transaction protocol
- Wireless session protocol
- Wireless application environment
- WAP Push Architecture, protocols

Chapter 9 : Introduction to Android Operating System& Programming [10]

- Overview and evolution of Android
- Features of Android
- Android architecture
- Components of an Android Application, Manifest file
- Android Activity and Service Lifecycle
- UI Designing (layout designinig)
- All components (e.g Button , Slider, Image view, Toast)
- Event Handling

Reference Books

1. Mobile Communications Jochen Schiller, Pearson Education, 2nd Edition, ISBN : 9780321123817
2. Beginning Android Application Development by Wei-Meng Lee Wiley India ISBN:9788126531066
3. Mobile Networks GSM and HSCSD- Nishit Narang, Sumit Kasera, TataMcGrawHill
4. Mobile Computing: Technology, Applications, and Service Creation by Asoke K. Talukder,
5. Beginning Android 3 by Mark Murphy APress , ISBN 9788132203568
6. The Android Developers Guide [<http://developer.android.com/guide/index.html>]

Note: -

- **For internal evaluation Android Application Development / Assignments are compulsory for 20 marks.**

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(CORE) CS 303: Soft Computing

No of Lectures: 48

Objective

- To understand the concepts of how an intelligent system work and its brief development process.

Prerequisites

- Probability
- First Order Predicate Logic
- Classical Logic
- Calculus

Description

Intelligent systems can function as intelligent assistants, augmenting or supplementing human expertise while increasing productivity. This course exposes learners to Neural Network, Fuzzy Logic and Genetic Algorithms, which are the major building blocks of Intelligent Systems.

Chapter 1 : Introduction to Fuzzy Logic

[16 to 20]

The Illusion : Ignoring Uncertainty and accuracy, Uncertainty and information, Fuzzy set and membership, Chance versus Fuzziness. Classical Sets, Fuzzy Sets, Cartesian Product, Crisp Relations, Fuzzy relations, Tolerance and equivalence Relations, Fuzzy Tolerance and equivalence Relations, Value assignments, Other Forms of the Composition Operations, Features of the membership Function, various forms, Fuzzification, Defuzzification to Crisp set, λ -Cuts for fuzzy Relations, Defuzzification to Scalars. Fuzzy Logic, Approximate Reasoning, Others forms of implication operations, Natural Language, Linguistic Hedges, Fuzzy (Ruled-Based) system, Graphical technique of inference, Membership value assignment-Intuition, Inference.

From Book 1 Chapters 1,2,3,4,5,6

Chapter 2 : Fuzzy System and Classification

[10 to 12]

Fuzzy System Simulation- Fuzzy Relation, Equations, Nonlinear Simulation Using Fuzzy Systems, Fuzzy Associative Memories.

Fuzzy Classification- Classification by Equivalence Relations, Cluster Analysis, Cluster Validity, c-Means Clustering, Hard c-Means, Fuzzy c-Means, Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering.

Fuzzy Arithmetic and Extension Principle-Extension Principle, Fuzzy Arithmetic, Interval Analysis in Arithmetic, Approximate Methods of Extension.

From Book 1 Chapters 8, 10, 12

Chapter 3 : Neural Network

[20 to 22]

Neural networks: Artificial Neural Network: Definition, Advantages of Neural Networks
Application Scope of Neural Networks

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Course Catalog for M. Sc. (Computer Science) Program

Fundamental Concept: Artificial Neural Network, Biological Neural Network, Brain vs. Computer-Comparison Between Biological Neuron and Artificial Neuron (Brain vs. Computer) Book3.

Artificial Neurons, Neural Networks and Architectures: Neuron Abstraction, Neuron Single Functions, Mathematical Preliminaries, Neural Networks Defined, Architectures: Feedforward and Feedback, Salient Properties of Neural Networks

Geometry of Binary Threshold Neurons and Their Networks: Pattern Recognition and Data Classification, Convex Sets, Convex Hulls and Linear Separability, Space of Boolean Functions, Binary Neurons are Pattern Dichotomizers, Non-linearly Separable Problems, Capacity of a Simple Threshold Logic Neuron, Revisiting the XOR Problem, Multilayer Networks, How Many Hidden Nodes are Enough?

Learning and Memory: An Anecdotal Introduction, Long Term Memory, The Behavioral Approach to Learning, The Molecular Problem of Memory, Learning Algorithms, Error Correction and Gradient Descent Rules, Learning Objective for TLNs, Pattern Space and Weight Space. From Book 2

Linear Separability, Hebb Network, Perceptron Network. From Book3
 α - Least Mean Square Learning, MSE Error Surface and Its Geometry, Steepest Descent Search with Exact Gradient Information, μ -LMS: Approximate Gradient Descent, Application of LMS TO Noise Cancellation.

From Book 2

Chapter 4 :Genetic Algorithms:

[2 to 4]

A Gentle Introduction to Genetic Algorithms: What are Genetic Algorithms? , Robustness of Traditional Optimization and Search Methods, The Goals of Optimization, How are Genetic Algorithms Different from Traditional Methods?, A simple Genetic Algorithm, Genetic Algorithms at Work—a Simulation by hand, Grist for the Search Mill—Important Similarities, Similarity Templates (Schemata), Learning the Lingo.

From Book 4

Reference Books

1. Fuzzy Logic With Engineering Applications, 3rd Edition By Timothy Ross , Wiley Publication
2. Neural Networks By Satish Kumar, Tata McGraw Hill
3. Introduction to Soft Computing by Deepa &Shivanandan, Wiley Publication
4. Genetic Algorithms in Search, Optimization and Machine Learning By David E. Goldberg, Pearson Education

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(ELECTIVE) CS 304: Project

- 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 and demonstration.
- You should fill your status of the project work on the progress report and get the Signature of project guide regularly. Progress report should sharply focus how much time you have spent on specific task. (The format of progress report is given as follow.)
- You should keep all signed progress report.
- Project will not be accepted if progress report is not submitted and all responsibility remains with student.
- Students should prepare design document using SE/UML techniques depends on your project.

About project Report: -

- The report should be typed on A4 size, executive bond paper for the final submission. The report should be in the good quality Rexene bound. We suggest, using one-and-half spaced printing, Times New Roman 12 font sizes for the normal text, 14-16 font sizes for headings & page titles.
- Number of copies:
For one project you should prepare 2 copies of the project report. One for yourself, one for college (**College copy can be in CD**).

Evaluation for internal 50 Marks

Description	Marks
UML Diagrams	10 M
Technology And Design Based First Demo	15 M
Project Technology Based 2 assignments	10 M
Second Demo	15M

Evaluation for external 50 Marks

Description	Marks
Demo	15 M
Report	15 M
Presentation	15 M
Viva	05M

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(ELECTIVE) CS 305: Web Services

No of lectures: 48

Pre-requisites

- Strong knowledge about Java programming.
- Good Understanding of Object Oriented Programming concepts.
- Must be familiar with XML.

Objectives

- To Understand Web Services and implementation model for SOA
- To Understand the SOA, its Principles and Benefits
- Understanding cloud computing as a web service
- Discuss the concept of virtualization and data in cloud.

Chapter 1 : Web Service and SOA fundamentals

[8]

Introduction, Concept of Software as a Service(SaaS), Web services versus Web based applications, Characteristics of Web services, Service interface and implementation, The Service Oriented Architecture(SOA), Quality of service (QoS), Web service interoperability, Web services versus components, RESTful services , Impact and shortcomings of Web services.

Chapter 2 : Web Services Architecture.

[8]

Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services, developing web services enabled applications.

Chapter 3 : SOAP: Simple Object Access Protocol

[10]

Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP communication model, Building SOAP Web Services, developing SOAP Web Services using Java, Error handling in SOAP, Advantages and disadvantages of SOAP.

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Chapter 4 : Describing and Discovering Web Services

[12]

WSDL in the world of Web Services, Web Services life cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL, Service discovery, role of service discovery in a SOA, service discovery mechanisms, UDDI – UDDI Registries, uses of UDDI Registry, Programming with UDDI, UDDI data structures, support for categorization in UDDI Registries, Publishing API, Publishing information to a UDDI Registry, searching information in a UDDI Registry, deleting information in a UDDI Registry, limitations of UDDI.

Chapter 5 : Emerging trends: Cloud Computing

[10]

What is Cloud Computing?, SOA meets the Cloud, Cloud Service Models, SaaS-Salesforce.com, PaaS-Google App Engine, IaaS-Amazon EC2, Cloud Deployment Models – Public, Community, Private, Hybrid. Virtualization , Virtual Machine(VM) Technology, Virtual Machine Monitor or Hypervisor - KVM, Xen, VMware hypervisors and their features, Multi-tenancy, Architecture model for Cloud Computing .
Case Study: Use Cloud Services – Amazon EC2, Google App Engine, Salesforce.com

Text books:

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.
4. Gautam Shroff, "Enterprise Cloud Computing", Cambridge.

Reference Books:

1. Building Web Services with Java, 2nd Edition, S. Graham and others, Pearson Edn., 2008.
2. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly, SPD.
3. J2EE Web Services, Richard Monson-Haefel, Pearson Education.
4. Java Web Services Programming, R. Mogha, V.V. Preetham, Wiley India Pvt.Ltd.
5. Ronald Krutz and Russell Dean Vines, "Cloud Security", Wiley-India
6. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.
7. Dr. Kumar Saurabh, "Cloud Computing", Wiley Publication
8. Borko Furht, "Handbook of Cloud Computing", Springer

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(ELECTIVE) CS 306: Database and System Administrator

No of lectures: 48

Pre-requisites

- Concepts of Databases
- Basic knowledge of any operating system and programming language.

Objectives

- This curriculum offers you the opportunity to acquire a combination of both Operating Systems & Database Administration skills.
- SDBA program gives you ideal opportunity to practice what you have learned through real life case studies.

DBMS Administration

Chapter 1 : Client/Server Concepts [1]

- Client server Architecture
- Invoking Client Programs

Chapter 2 : MySQL Client Program [4]

- Using MySQL interactively
- Statement Terminators
- Using Script Files with MySQL
- MySQL Output Formats
- Client Commands and SQL Statements
- Using Server-Side Help
- Using the – safeupdates Option

Chapter 3 : MySQL Architecture [3]

- Client/Server Overview
- Communication Protocols
- The SQL Parser and Storage Engine
- Tiers
- How MySQL Uses Disk Space
- How MySQL Uses Memory

Chapter 4 : Starting, Stopping, and Configuring MySQL [3]

- Types of MySQL Distributions
- Starting and Stopping MySQL Server on Windows
- Starting and Stopping MySQL Server on Unix
- Runtime MySQL Configuration
- Log and Status Files

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

- Loading Time Zone Tables
- Security-Related Configuration
- Setting the Default SQL mode
- Upgrading MySQL

Chapter 5 : Locking [2]

- Locking Concepts
- Explicit Table Locking
- Advisory Locking

Chapter 6 : Storage Engines [5]

- MySQL Storage Engines
- The MyISAM Engine
- The MERGE Engine
- The InnoDB Engine
- The MEMORY Engine
- The FEDERATED Engine
- The Cluster Storage Engine
- Other Storage engines

Chapter 7 : Data (Table) Maintenance [3]

- Types of Table Maintenance Operations
- SQL Statements for Table Maintenance
- Client and Utility Programs for Table Maintenance
- Repairing InnoDB Tables
- Enabling MyISAM Auto-Repair

Chapter 8 : Data Backup and Recovery Methods [3]

- Introduction
- Binary Versus Textual Backups
- Making Binary Backups
- Making Text Backups
- Backing Up Log and Status Files
- Replication as an Aid to Backup
- MySQL Cluster as Disaster Prevention
- Data Recovery

System Administration

Chapter 9 : Introduction [1]

- Know Your PC
- Different Linux Distribution
- Daily tasks of system Administrator
- Responsibilities of System Administrator

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Chapter 10 : Linux Installation [2]

- Text VS Graphics
- Partitioning & Disk management
- GUI Configuration

Chapter 11 : File manipulations Under Linux [4]

- Copy rename, delete & move
- File & directory listing
- File handling & I/O redirection
- File systems and their types
- Names & contents of important Unix/Linux file directories
- Compatibility of file Systems
- fsck & Disk check Commands, Log files

Chapter 12 : Command Line Interface [3]

- Text Manipulation Commands e.g. cut, grep, egrep, split, paste
- Vi editor
- su, ps, find, make, df/du
- Introduction to Regular expression
- awk, sed, passwd, wc, Antivirs, utilities, tar, gzip/gunzip, accessing pen drive, CD

Chapter 13 : Users and Groups [2]

- Concept of users & groups
- Owner creator
- Primary and Secondary group
- Types of file and directory permission

Chapter 14 : Startup/shut down [2]

- Booting
- Run Levels
- /etc/init tab
- shut down
- handling crashes

Chapter 15 : Basic system Administration [6]

- Managing Users and groups (from console & GUI modes) Using command like adduser, userdel, groupadd, groupdel etc.
- Basic Network Setup Setting hostname, IP address of the machine. Setting a dialup connection.

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

- Installing and removing packages. Using the RPM, source package installation, URPMI.
- Managing Partitions
- Boot loader management Understanding the lilo and grub boot loader and its configuration files.
- Configuring services, chkconfig, ntsys, start, Resart & stop Service

Chapter 16 : Networking [2]

- Internetworking with windows (samba)
- Ping Telnet, ftp program
- NIS, NFS, Tomcat web server

Chapter 17 : Print Services [2]

- Printers Installation
- Print command

Reference Books

1. Linux System Administrator's guide by Lars Wirzenius, Joanna Oja, Stephen Stafford, Alex Weeks
2. Linux Administration Made Easy by Steve Frampton
3. MySQL 5 for Professionals By Ivan Bayross, Sharanam Shah [SPD Publications]
4. High Performance MySQL By Jeremy D. Zawodny, Derek J. Balling [O'Reilly Media Publications]
5. MySQL in a Nutshell By Russell Dyer [O'Reilly Media Publications]

Important Links

1. http://www.thegeekstuff.com/2008/11/overview-of-mysql-information_schema-database-with-practical-examples/
2. <http://www.learn-mysql-tutorial.com/Identifiers.cfm>

Note: -

- Some chapters are practical oriented so faculty should teach those chapter with demonstration.
- And, those chapters are kept for internal evaluation.
- Hence, hands on must be taken for these chapters.

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(ELECTIVE) CS 307: Functional Programming

No of Lectures: 48

Prerequisites

Anyone who has a mature understanding of programming in an imperative language (e.g., Java, C/C++, or Pascal), of basic algorithms and data structures (e.g., sorting, searching, lists, stacks, and trees), and of basic discrete mathematics (e.g., sets, relations, functions, induction, and simple algebraic concepts)

Objectives

- Understand what functional programming is, what different variants are there and have some grasp of their history;
- Explain the semantics of different functional languages using precise formal specifications;
- Know how to implement functional languages and what optimizations are important;
- Be able to state and critique what it means for an implementation of a functional programming language to be correct;
- Be able to (in principle) formally prove correctness of their implementations, including their compilers and garbage collectors

Chapter 1 : Introduction to FP & Mathematical Functions

[6]

Principles of FP, History, Varieties of FP languages, Declarative style of programming, Declarative style of programming, Why functional programming Mathematical functions : definition, lambda expression, Functional Forms or a higher-order function :- Function Composition, Construction, Apply-to-all, Disadvantages of FP

Chapter 2 : Introduction to Lambda calculus

[12]

Introduction, The benefits of lambda notation, Lambda calculus as a formal system - Lambda terms (Variables, Constants, Combinations, Abstractions), Free and bound variables, Substitution, Conversions (Alpha conversion, Beta conversion, Eta conversion), Lambda equality, Lambda reduction, Reduction strategies, Combinators

Chapter 3 : Reduction strategies and lazy evaluation

[8]

Reduction, Evaluation in a strongly typed language, What is reduction?, 2 types of reduction rules, Reduction rules, Alternate reductions, Reduction strategies - Eager evaluation and Lazy Evaluation, Advantages and disadvantages of reduction strategies, Graph Reduction, Reduction of higher order functions and currying

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Chapter 4 : Introduction to Python

Scripting versus Traditional Programming

[2]

Why Scripting is Useful in Computational Science, Classification of Programming Languages, Productive Pairs of Programming Languages, Gluing Existing Applications, Scripting Yields Shorter Code, Efficiency, Type-Specification (Declaration) of Variables, Flexible Function Interfaces, Interactive Computing, Creating Code at Run Time, Nested Heterogeneous Data Structures, GUI Programming, Mixed Language Programming, When to Choose a Dynamically Typed Language, Why Python?, Script or Program?

Chapter 5 : Basic Python

[2]

Python identifiers and reserved words, Lines and indentation, multi-line statements, comments, print and raw_input()/input, command line arguments and processing command line arguments, standard data types - basic, none, boolean (true & False), numbers, Python strings, data type conversion, Python basic operators (Arithmetic, comparison, assignment, bitwise logical), Python membership operators (in & not in), Python identity operators (is & is not), Operator precedence, Control Statements, Python loops, Iterating by subsequence index, loop control statements (break, continue, pass), Mathematical functions and constants (import math), Random number functions

Chapter 6 : Python strings

[4]

Concept, Slicing, escape characters, String special operations, String formatting operator, Triple quotes, Raw String, Unicode strings, Built-in String methods.

Python Lists - concept, creating and accessing elements, updating & deleting lists, basic list operations, reverse, Indexing, slicing and Matrices, built-in List functions, Functional programming tools - filter(), map(), and reduce(), Using Lists as stacks and Queues, List comprehensions

Chapter 7 : Python tuples and sets

[1]

Concept (immutable), creating & deleting tuples, accessing values in a tuple, updating tuples, delete tuple elements, basic tuple operations, Indexing, slicing and Matrices, built-in tuple functions. Sets - Concept, operations.

Chapter 8 : Python Dictionary

[1]

Concept (mutable), creating and accessing values in a dictionary, updating dictionary, delete dictionary elements, properties of dictionary keys, built-in dictionary functions and methods.

Chapter 9 : Functions

[3]

Defining a function (def), calling a function, Function arguments - Pass by value, Keyword Arguments, default arguments, Scope of var - basic rules and, Documentation Strings, Variable Number of Arguments, Call by Reference, Order of arguments (positional, extra & keyword), Anonymous functions, Recursion, Treatment of Input and Output Arguments, Unpacking argument lists, Lambda forms, Function Objects, function ducktyping & polymorphism, generators (functions and expressions) and iterators, list comprehensions

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Chapter 10 : Working with Files and Directories

[3]

Creating files, Operations on files (open, close, read, write), file object attributes, file positions, Listing Files in a Directory, Testing File Types, Removing Files and Directories, Copying and Renaming Files , Splitting Pathnames, Creating and Moving to Directories, Traversing Directory Trees

Chapter 11 : Python Classes / Objects

[3]

Object oriented programming and classes in Python - creating classes, instance objects, accessing members, data hiding (the double underscore prefix), built-in class attributes, garbage collection, the constructor, overloading methods and operators, inheritance - implementing a subclass, overriding methods, Recursive calls to methods, Class variables, class methods, and static methods

Chapter 12 : Python regular expressions

[1]

Matching Vs searching, match & search functions, search & replace, option flags, RE patterns, non-greedy repetitions, grouping, back references, alternatives, anchors.

Chapter 13 : Python Exceptions

[1]

Exception handling, assert statement, except clause - with no exceptions and multiple exceptions, try - finally, raising exceptions, user-defined exceptions

Reference Books

1. Functional Programming: Practice and Theory by Bruce J. MacLennan
 - ISBN-10: 0201137445
 - ISBN-13: 978-0201137446
2. An Introduction to Functional Programming Through Lambda Calculus (Dover Books on Mathematics) Paperback by Greg Michaelson
 - ISBN-10: 0486478831
 - ISBN-13: 978-0486478838
3. Computational Semantics with Functional Programming by Jan van Eijck (Author), Christina Unger (Author)
 - ISBN-10: 0521757606
 - ISBN-13: 978-0521757607
4. Programming Languages: Principles and Practice By Kenneth C. Loudon
 - ISBN-10: 1575864967
 - ISBN-13: 978-1575864969
5. E-Books : python_tutorial. pdf, python_book_01.pdf

Note: -

- **For Internal Evaluation ,
20M Theory + 30M Programming**

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(ELECTIVE) CS 308: Business Intelligence

No of lectures: 48

Pre-requisites

- Relational database concepts, database design and entity-relationship (E-R) modeling, data normalization, and Structured Query Language (SQL).
- Data Mining techniques

Objectives

- Understand the role of BI in enterprise performance management and decision support.
- Understand the applications of data mining and intelligent systems in managerial work.
- Understand data warehousing and online analytical processing (OLAP) concepts, including dimensional modeling, star and snowflake schemas, attribute hierarchies, metrics, and cubes.
- Learn data analysis and reporting using an available BI software.

Chapter 1 : Introduction to Business intelligence [6]

Definition and History of BI, Transaction processing versus analytical processing, BI implementation , Major tools and techniques of BI

Chapter 2 : Data warehousing [10]

Definition and concepts, , Data warehouse architecture, ETL process, data warehouse development, Top down vs. Bottom up, Data Mart vs. EDW, Implementation issues, Real-time data warehousing

Chapter 3 : Business performance management [14]

Key performance indicators and operational metrics, Balanced scorecard , Six Sigma , Dashboards and scorecards

Chapter 4 : Data Mining for Business Intelligence [10]

Data mining process, Data mining methods, ANN for Data Mining

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Chapter 5 - Text, and Web mining for Business intelligence [08]

Text mining Applications, Process and Tools, Web content, structure and usage mining

Chapter 6 : BI implementation , Integration and emerging trends [10]

Implementing BI, BI Application Life Cycle , Connecting BI to Enterprise systems, On-demand BI, Issues of legality, privacy and Ethics, Emerging topics in BI, Social Networking and BI, RFID and BI

Reference Books

1. Business Intelligence: A Managerial Approach, 2nd Edition, PEARSON 2012
Authors: Efraim Turban, Ramesh Sharda, Dursun Delen, and David King
ISBN-10: 0-13-610066-X
ISBN-13: 978-0-13-610066-9
2. Oracle Business Intelligence Applications, McGraw Hill Education 2013
Authors : Simon Miller, William Hutchinson ISBN-10: 93-5134-153-4
ISBN-13: 978-93-5134-153-6

Note :-

- **Group wise Case studies can be given for Internal Evaluation.**

M.Sc (Computer Science)

Part - II / Semester 4

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(CORE) CS 401: Full Time Industrial Training/ Industrial Project

Period – Minimum 4 months

1. There will be a teacher coordinator for a group of students. A teacher coordinator will take care of joining letters from students along with other necessary submission listed below.
2. A student will have to submit 2 reports during the period of ITP to the Department of the college.
3. After the completion of the ITP, a student will have to submit a synopsis along with the project completion certificate from the respective industry/research institute /educational institute.
4. A student will submit one hard copy (Student Copy) and a soft copy's (preferably 2 CDs) of the work carried out towards ITP.
5. The project will be graded by the experts (One internal examiner, one external examiner(academic expert) and one industrial expert) as follows:

O – 75 and above	C – 50 and above	F - A student will have to carry out project once again for a complete semester
A – 65 and above	D – 45 and above	
B – 55 and above	E – 40 and above	

Important Note: A student can complete ITP with a research project of a teacher / an expert funded by the University of Pune/ a funding agency.

Evaluation for internal 50 Marks will be done according to Progress Report written by Teacher Coordinator

Evaluation for external 50 Marks will be done by Industrial Expert, Academic Expert and One Internal Examiner.

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(ELECTIVE) CS 402: Parallel Computing

No. of lectures: 48

Pre-requisites

- Ability to program well in C, C++ or Fortran.
- Willingness to rethink how problems should be solved.
- Algorithm & Data Structures
- Basics of Computer Architecture

Objectives

- Learning basic models of parallel machines and tools
- How to parallelize programs and how to use basic tools like MPI and POSIX threads.

Chapter 1 : Introduction to Parallel Computing [6]

Why Parallel Computing & Scope of Parallel Computing, Sieve of Eratosthenes, Control and Data Approach, PRAM model of parallel computation, Design paradigms of Parallel Computing, examples, Bulk Synchronous Parallel (BSP) model.

Chapter 2 : Classification [12]

Flynn's Taxonomy, MPP, SMP, CC-NUMA, Clustering of Computers, Beowulf Cluster, Use of MPI in Cluster Computing. Debugging, Evaluating and tuning of Cluster Programs, Partitioning and Divide and Conquer Strategies. Cluster: dedicated high performance (HP), high availability (HA), CoPs, PoPs, CoWs; distributed, on-demand, high-throughput, collaborative, data-intensive computing, Interconnection networks.

Chapter 3 : An overview of Parallel Programming Paradigms [10]

Foster's design paradigm for Multi computing programming, Programmability Issues, Programming Models: Message passing, Message passing standards: PVM (Parallel Virtual Machine), MPI (Message Passing Interface) and its routines, Advanced Features of MPI

Chapter 4 : Overview of Programming with Shared Memory [12]

Overview of Programming with Shared Memory: OpenMP (History, Overview, Programming Model, OpenMP Constructs, Performance Issues and examples, Explicit Parallelism: Advanced Features of OpenMP)

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Chapter 5 : Multi-Core programming

[8]

Multi-Core programming: Introduction to Multi cores Programming Software Multi-threading using Tread Building Blocks (TBB) and Cilk++ programming, GPGPU programming with CUDA

Reference Books

1. Quinn, M. J., Parallel Computing: Theory and Practice (McGraw-Hill Inc.).
2. Bary Wilkinson and Michael Allen: Parallel Programming Techniques using Networked of workstations and Parallel Computers, Prentice Hall, 1999.
3. R. Buyya (ed.) High Performance Cluster Computing: Programming and Applications, Prentice Hall, 1999.
4. William Gropp, Rusty Lusk, Tuning MPI Applications for Peak Performance, Pittsburgh (1996).
5. W. Gropp, E. Lusk, N. Doss, A. Skjellum, A high performance portable implementation of the message passing Interface (MPI) standard, Parallel Computing 22 (6), Sep 1996.
6. Gibbons, A., W. Rytter, Efficient Parallel Algorithms (Cambridge Uni. Press).
7. Shameem A and Jason, Multicore Programming, Intel Press, 2006.
8. CUDA Programming A Developer's Guide to Parallel Computing with GPUs Shane Cook, Morgan Kaufmann

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(ELECTIVE) CS 403: Embedded System

No of Lectures: 48

Pre-requisites

- Knowledge of microprocessor architecture and assembly language, microprocessor peripherals, digital design, and the C programming language is a prerequisite for this course.
- An understanding of compilers, assemblers, linkers, operating systems, analog design, diodes, transistors, and electromagnetic fields and waves will be useful

Objectives

- Understand and design embedded systems and real-time systems
- For real-time systems:
 - Identify the unique characteristics of real-time systems
 - Explain the general structure of a real-time system
 - Define the unique design problems and challenges of real-time systems
- Apply real-time systems design techniques to various software programs.
- For embedded systems, it will enable you to :
 - Understand the basics of an embedded system
 - Program an embedded system
 - Design, implement and test an embedded system.

Chapter 1 : Introduction to ES

[2]

- What is ES
- Examples of ES
- Inside ES : processor, memory, peripherals, software

Chapter 2 : Embedded Processors , Memories & Peripherals

[6]

- Microcontrollers 8051
- Discrete processors : 8-bit architecture, 16/32 bit CISC, RISC, DSP
- Integrated processors : ARM RISC
- Choosing a processor
- Memory systems : types (SRAM, DRAM, FLASH), organization, access time, validating the contents of memory
- Basic peripherals : parallel ports, timers, clocks

Chapter 3 : Real time system concepts

[12]

- Foreground/ background systems
- Critical section of code
- Resource, shared resource
- Multitasking, task, task switch

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

- Kernel, scheduler, non-preemptive kernel, preemptive kernel
 - Reentrancy, round-robin scheduling
 - Task priority, static priority, dynamic priority, priority inversions, assigning task priorities
 - Mutual exclusion, deadlock, synchronization, event flags, intertask communication
 - Interrupts : latency, response, recovery, ISR processing time, NMI
- (For 'C' implementation of above concepts, please refer to chapters 4,5,6,7 of the book "An Embedded Software Primer" by David E. Simon published by Pearson Educations)

Chapter 4 : Writing software for embedded systems [8]

- The compilation process : compile, link, load
- Cross compilers
- Run-time-libraries : processor dependent, I/O dependent, system calls,exit routines
- Writing a library, using alternative libraries
- Porting Kernels
- C extensions for embedded systems
- Buffering and other data structures
 - Linear buffers, Directional buffers, Double buffering, Buffer exchange, Linked lists, FIFO, Circular buffers, Buffer underrun and overrun, Allocating buffer memory, Buffer leakage
- Downloading

Chapter 5 : Emulation and Debugging techniques [6]

- Debugging techniques :
 - HLL simulation, low level simulation, on-board debugger, task level debugging, symbolic debug
- Emulation
- Optimization problems

Chapter 6 : Basic design using RTOS [6]

- Overview
- Principles
- Example
- Encapsulating semaphores and queues
- Hard real time scheduling considerations
- Saving memory space
- Saving power

Chapter 7 : Real time without RTOS [8]

- Choosing the SW environment
- Deriving real time performance from non-real time system
- Scheduling and data sampling
- Controlling from an external switch
- Problems

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Reference Books

1. Embedded Systems Design – Steve Heath
2. Programming Embedded Systems – Michael Barr
3. Embedded Systems Building Blocks _ Jean J. Labrosse
4. An Embedded Software Primer _ David E. Simon published by Pearson Educations

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(ELECTIVE) CS 404: Software Quality Assurance

No of lectures: 48

Pre-requisites

- Basic concepts of software testing

Objectives

- To enable student to learn Software Quality Assurance good practices with the help of various techniques, Strategies and tools

Chapter 1 : Software quality

[4]

- Definition
- Software errors, software faults and software failures
- Software quality assurance – definition and objectives
- Software quality assurance vs. software quality control
- The objectives of SQA activities

Chapter 2 : Pre-project SQA Components

[4]

- Contract Review
- Development and Quality Plan

Chapter 3 : SQA components in Project life cycle activities assessment

[10]

- Verification and Validation
- Various types of Reviews
- Inspections
- Walkthrough
- Software testing
- Impact of CASE Tools

Chapter 4 : SQA Infrastructure Components

[8]

- Procedures and procedure manuals
- Templates and Checklists
- Staff training
- Corrective and preventive actions
- Documentation control

Chapter 5 : Software Quality Factors

[5]

- McCall's Quality Model
- Product, Process quality metrics

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Chapter 6 : Standardization	[4]
<ul style="list-style-type: none">• ISO 9001 and ISO 9000-3• SEI-CMM,• IEEE 1012 standard• ISO/IEC 12207 standard	
Chapter 7 : Configuration Management	[4]
<ul style="list-style-type: none">• Change control• Release and version control• Software configuration management audit	
Chapter 8 : Quality Improvement Technique	[4]
<ul style="list-style-type: none">• Pareto Diagrams• Cause-Effect Diagrams• Scatter Diagrams• Run Charts	
Chapter 9 : Quality Costs	[5]
<ul style="list-style-type: none">• Quality Cost Measurement• Utilizing Quality Costs for Decision-Making	

Reference books

1. Software Quality Assurance from theory to implementation – Danial Galin
2. Software Project management - Edwin Bennatan
3. Software Engineering Roger S. Pressman, TMH, 7Th Ed.
4. Software Quality Assurance : Principles and Practices Nina Godbole,
5. Project Management Body of Knowledge – PMI
6. www.softwarecertifications.org
7. Quality, 5th ed., Prentice-Hall, 2010. Donna C. S. Summers
8. Total Quality Management, Prentice Hall, 2003. Dale H. Besterfield
9. Software engineering: An Engineering approach, John Wiley. J.F.Peters, W.Pedrycz

Note: -

- **Group wise case studies are expected as a part of Internal Evaluation.**

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(ELECTIVE) CS 405: Modeling and Simulation

No of lectures: 48

Pre-requisites

- The course assumes a previous knowledge of probability and statistics.
- Basic concepts of network topologies.

Objectives

- The purpose of this course is to provide students with an opportunity to develop skills in modeling and simulating a variety of problems.
- After learning the simulation techniques, the students are expected to be able to solve real world problems which cannot be solved strictly by mathematical approaches.

Chapter 1 : Systems modeling [2]

Concepts of continuous and discrete formalisms. Stepped and Event-based Time in Simulations, Sources and Propagation of Error

Chapter 2 : Types of Simulations [4]

Graph or Network Transitions Based Simulations, Actor Based Simulations, Mesh Based Simulations, Hybrid Simulations, Framework for Simulation and Modeling,

Chapter 3 : Modeling and simulators [20]

Modeling formalisms and their simulators, discrete time, continuous time, discrete event, process based simulators. Hybrid systems and their simulators

Chapter 4 : Probability [8]

Basic probability, probability distributions, estimation, testing of hypotheses

Chapter 5 : Probability in modeling [8]

Selecting input probability distributions, models of arrival processes, Queues and Random Noise, Random number generators, their evaluation, generating random variates from various distributions

Chapter 6 : Analyzing models [6]

Output analysis, transient behavior, steady state behavior of stochastic systems, computing alternative systems, variance reduction techniques. Sensitivity Analysis, Verification and Validation

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

Text books

1. Discrete-Event System Simulation, Fourth Edition, Banks, by J., et.el. (2005), Publisher Pearson, ISBN-13: 9780131293427
2. Simulation Modeling and Analysis, Third Edition, by Law, A.M. and W.D. Kelton (2000), Publisher McGraw-Hill, ISBN-13: 978-0071165372

Reference Books

1. Continuous System Simulation, by Kofman and Cellier, Publisher Springer, ISBN-13: 9780387261027
2. Theory of modeling and Simulation, 2nd ed., B. Zeigler, H. Praehofer, T. Kim, Publisher Academic Press, 2000, ISBN-13: 978-0127784557
3. Modeling with Data: Tools and Techniques for Scientific Computing, by Ben Klemens, Publisher: Princeton University Press 2008, ISBN-13: 9780691133140

Note: -

- Hands on can be taken with any simulating software.

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

M.Sc. (Computer Science) End Semester Examination Paper Layout for Semester 3 and Semester 4

CS-301: Software Metrics and Project Management

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows:

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Project Management	6
2	Project Management Components	10
3	Scope Management	6
4	Time Management	4 (Numerical)
5	Cost Management	4 (Numerical)
6	Quality Management	4
7	Human Resource Management	4
8	Communication Management	4
9	Risk Management	4
10	Procurement Management	4
11	Software Metrics	10
12	Software Reliability	10
13	Planning a measurement Program	6
14	Quality Standards	4

Numerical weightage : 15M

Different Types of Numerical on topics Cost Management (COCOMO), Time Management.

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units.

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-302: Mobile Computing

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Mobile Computing	04
2	Wireless Transmission	06
3	Medium Access Control Layer	08
4	Mobile IP	14
5	Mobile TCP	10
6	GSM	14
7	3G mobile networks	12
8	Wireless Application Protocol	08
9	Introduction to Android Operating System & Programming	04

Examiner should note that, there should not be any programming question for chapter 9. (Only theory must be asked.)

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-303: Soft Computing

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Fuzzy Logic	22
2	Fuzzy System and Classification	18
3	Neural Network	30
4	Genetic Algorithms	10

Fuzzy Logic: 40

Neural Networks: 30

Genetic Algorithms: 10

Every question from Q.1 to Q.8 must contain at least 1 numerical.

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units

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Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-305: Web Services

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Web Service and SOA fundamentals	08
2	Web Services Architecture	10
3	SOAP: Simple Object Access Protocol	20
4	Describing and Discovering Web Services	22
5	Emerging trends: Cloud Computing	20

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-306: Database and System Administrator

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Client/Server Concepts	4
2	MySQL Client Program	12
3	MySQL Architecture	12
4	Starting, Stopping, and Configuring MySQL	NIL
5	Locking	4
6	Storage Engines	16
7	Data (Table) Maintenance	NIL
8	Data Backup and Recovery Methods	4
9	Introduction	4
10	Linux Installation	NIL
11	File manipulations Under Linux	16
12	Command Line Interface	NIL
13	Users and Groups	4
14	Startup/shut down	NIL
15	Basic system Administration	NIL
16	Networking	4
17	Print Services	NIL

Chapters for which weightage written as "NIL", are kept for Internal Evaluation. And, End Semester exam will have questions only from remaining chapters.

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-307: Functional Programming

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to FP & Mathematical Functions	10
2	Introduction to Lambda calculus	20
3	Reduction strategies and lazy evaluation	12
4	Introduction to Python	04
5	Basic Python	04
6	Python strings	04
7	Python tuples and sets	02
8	Python Dictionary	04
9	Functions	06
10	Working with Files and Directories	06
11	Python Classes / Objects	04
12	Python regular expressions	02
13	Python Exceptions	02

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-308: Business Intelligence

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Business intelligence	08
2	Data warehousing	14
3	Business performance management	20
4	Data Mining for Business Intelligence	14
5	Text, and Web mining for Business intelligence	12
6	BI implementation , Integration and emerging trends	12

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

(Elective) CS 402: Parallel Computing

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Parallel Computing	10
2	Classification	20
3	An overview of Parallel Programming Paradigms	16
4	Overview of Programming with Shared Memory	18
5	Multi-Core programming	16

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-403 Embedded System

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to ES	04
2	Embedded Processors , Memories & Peripherals	10
3	Real time system concepts	20
4	Writing software for embedded systems	12
5	Emulation and Debugging techniques	12
6	Basic design using RTOS	10
7	Real time without RTOS	12

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS-404 Software Quality Assurance

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Software quality	6
2	Pre-project SQA Components	6
3	SQA components in Project life cycle activities assessment	18
4	SQA Infrastructure Components	14
5	Software Quality Factors	8
6	Standardization	6
7	Configuration Management	6
8	Quality Improvement Technique	6
9	Quality Costs	10

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units

Clarification for Extended Profile- 1.1 List of Courses offered across all programs during last five years.

Course Catalog for M. Sc. (Computer Science) Program

CS 405 : Modelling and Simulation

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Systems modeling	04
2	Types of Simulations	08
3	Modeling and simulators	30
4	Probability	14
5	Probability in modeling	14
6	Analyzing models	10

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
 - There should not be more than one sub questions on the same unit
 - There should not be more than one question containing sub questions on the same pair of units