NORTH MAHARASHTRA UNIVERSITY, JALGAON – 425 001

School of Computer Sciences

COURSE STRUCTURE WITH CREDIT

M.Sc. (Computer Science)

	Course	Marks	Hour/week	Credit	Total
Semester-I	**CS-101**	100	04	04	**24**
	CS-102	100	04	04	
	CS-103	100	04	04	
	CS-104	100	04	04	
	CS LAB-I	100	06	04	
	CS LAB-II	100	06	04	
Semester-II	**CS-201**	100	04	04	**27**
	CS-202	100	04	04	
	CS-203	100	04	04	
	CS-204	100	04	04	
	CS LAB-III	100	06	04	
	CS LAB-IV	100	06	04	
	CS-205 (Softskill Development Course)	75	02	03	
Semester-III	**CS-301**	100	04	04	**25**
	CS-302	100	04	04	
	CS-303	100	04	04	
	CS-304	100	04	04	
	CS LAB-V	100	06	04	
	CS LAB-VI	100	06	04	
	CS-305 (Seminar)	25	01	01	
Semester-IV	**CS-401**	100	04	04	**24**
	CS-402	100	04	04	
	CS-403	100	04	04	
	CS-404 (Project)	200	12	08	
	CS LAB-VII	100	06	04	

NORTH MAHARASHTRA UNIVERSITY, JALGAON
School of Computer Sciences

Proposed SYLLABUS for M. Sc. (Computer Science)
(With effect from June-2013)

Semester-I

CS-101 Advance C++ Programming
CS-102 Automata Theory and Computability
CS-103 Advance Operating Systems
CS-104 Digital Image Processing
CS-Lab-I Lab on Advance OS &DIP
CS-Lab-II Lab on C++ Programming

Semester-II

CS-201 Advance Java Programming
CS-202 Intelligent Systems
CS-203 Compiler Construction
CS-204 Design & Analysis of Algorithms
CS-205 Soft Skills Development
CS-Lab-III Lab on DAA and Intelligent Systems
CS-Lab-IV Lab on Advanced JAVA Programming

Semester-III

CS-301 Natural Language Processing
CS-302 Data Mining
CS-303 Programming with Windows Technologies
CS-304 Internet Computing
CS-305 Seminar
CS-Lab-V Lab on Windows Technologies
CS-Lab-VI Lab on Internet Computing & NLP

Semester- IV
CS-401 Software Engineering
CS-402 Current Computing Trends
CS-403 Optimization Algorithms
CS-404 Project
CS-Lab-VII Lab on Current Computing Trends

CS-101 Advance C++ Programming

1. Inheritance and Polymorphism: [6]
Class Derivation, Access Control, Base Class Initialization, Initializing Class Type Members, Polymorphism and Virtual Functions, Pointer Conversion, Virtual Destructors, Abstract Classes and Pure Virtual Functions

2. Advanced Polymorphism and Inheritance: [6]
Orthodox Canonical Form, Public, Private and Protected Inheritance, Composition vs. Inheritance, Templates vs. Inheritance, Interface Encapsulation

3. Inheritance Hierarchies and Multiple Inheritances: [8]
Smalltalk Style Class Hierarchies, Collection Classes in Object-Based Hierarchies, Independent Class Hierarchies in C++, Multiple Inheritance, Resolving Ambiguities, Duplicate Subobjects Virtual Base Classes

4. Exception Handling: [5]
C++ Exception Mechanism, Exceptions Compared to Other Error Handling Techniques, throw, try and catch, Exception Context and Stack Unwinding, Uncaught Exceptions, Automatic Cleanup in Exception Handling

5. File Handling [5]
Classes For File Stream Operations, Opening and Closing a File, Opening Files Using Constructor, Opening Files by using open() function, File mode Parameters, File Pointers
Sequential File, Detecting End-of-File, Functions for Manipulation of File Pointers, Specifying the Offset, Binary File, Reading and Writing a Class Object, Updating a File, Command-Line Arguments, this Pointer

6. Runtime Type Information: [5]
Runtime Type Information (RTTI) Mechanism, type_info Class and typeid Operator, Type Safe Pointer Conversion, New C++ Cast Syntax

7. An Overview of Templates: [5]
Templates, Overloading functions, Template functions, Specializing a template function, Disambiguation under specialization, Template classes, An array template class, Instantiating a template class object, Rules for templates, Non member function with a template argument Friends of template classes, Templates with multiple type parameters, Non type parameters for template classes, Comments regarding templates

8. Overview of the Standard Template Library: [3]
Perspective, History and evolution, New features in C++, The Standard Template Library, Design goals, Header files, STL components, Containers, Algorithms, Iterators

9. STL Iterators: [2]
Input iterators, Output iterators, Forward iterators, Backward Iterators, Random Access Iterators

10. STL Components: [5]

Sequence Containers, Associative Containers, and Adaptors: container adaptors and iterator adaptors

BOOKS:

1. C++ Programming 7Th Ed. Wiely Publications By Al Stevens
2. B. M. Harwani, "C++ for Beginners", Shroff publishers and Distributors Pvt. Ltd., ISBN: 9788184046564
3. David R. Musser, AtulSaini, "STL Tutorial & Reference guide", Person Education Asia, Second Indian Reprint 2000, ISBN-81-7808-132-6.
4. The STL primer Prentice Hall PTR, By Graham Glass, Brett L. Schuchert

CS-102 Automata Theory and Computability

1. **Grammars** - Production systems - Chomskian Hierarchy - Right linear grammar and Finite state automata - Context free grammars - Normal forms - uvwxy theorem – Parikh mapping - Self embedding property - Subfamilies of CFL - Derivation trees and ambiguity. [8]
2. **Finite state Automata** - Non deterministic and deterministic FSA, NFSA with ε- moves, Regular Expressions - Equivalence of regular expression and FSA . [8]
3. **Pumping lemma** , closure properties and decidability. Myhill - Nerode theorem and minimization - Finite automata with output. [4]
4. **Pushdown automata** - Acceptance by empty store and final state - Equivalence between pushdown automata and context-free grammars - Closure properties of CFL - Deterministic pushdown automata. [4]
5. **Turing Machines** - Techniques for Turing machine construction - Generalized and restricted versions equivalent to the basic model - Godel numbering - Universal Turing Machine - Recursively enumerable sets and recursive sets - Computable functions - time space complexity measures - context sensitive languages and linear bound automata. [8]
6. **Decidability**; Post's correspondence problem; Rice's theorem; decidability of membership, emptiness and equivalence problems of languages. [6]
7. **Complexity Measures** Time and tape complexity measures of Turing machines; Random access machines; the classes P and NP; NP-Completeness; satisfiability and Cook's theorem; Polynomial reduction and some NP-complete problems. [8]
8. **Advanced topics**; Regulated rewriting L systems; Grammar systems. [2]
9. **New paradigms of computing**; DNA computing; Membrane computing. [2]

BOOKS:

1. K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education, 2009.
2. J.E.Hopcroft, R.Motwani and J.D.Ullman , "Introduction to Automata Theory Languages and computation", Pearson Education Asia , 2001.
3. Peter Linz, "An Introduction to Formal Language and Automata", 4th Edition, Narosa Publishing house , 2006.
4. M.Sipser; Introduction to the Theory of Computation; Singapore: Brooks/Cole, Thomson Learning, 1997.
5. John.C.martin, "Introduction to the Languages and the Theory of Computation",Third edition, Tata McGrawHill, 2003

CS-103 Advance Operating Systems

1. Overview: **[6]**

General Overview of the System : History – System structure – User perspective – Operating system services – Assumptions about hardware. Introduction to the Kernel : Architecture of the UNIX operating system – Introduction to system concepts.

2. **The Buffer Cache**   **[6]**

Buffer headers – Structure of the buffer pool – Scenarios for retrieval of a buffer (algorithm: getblk) – Reading and writing disk blocks (algorithm: breada, bwrite)– Advantages and disadvantages of the buffer cache.

3. File Subsystem: **[10]**

Internal representation of files: Inodes – Structure of a regular file (algorithm: bmap)– Directories – Conversion of a path name to an Inode (algorithm: namei) – Super block – Inode assignment to a new file (algorithm: ialloc) – Allocation of disk blocks.

4. System Calls for the File System: **[10]**

 Open – Read – Write – File and record locking – Adjusting the position of file I/O – Lseek – Close – File creation – Creation of special files – Changing directory, root, owner, mode – stat and fstat – Pipes – Dup – Mounting and unmounting file systems (algorithm: mount, umount) – link – unlink.

5. Processes: **[10]**

Process states and transitions – Layout of system memory – The context of a process – Saving the context of a process – Manipulation of the process address space – Sleep (algorithm: sleep). Process Control : Process creation – Signals – Process termination – Awaiting process termination – Invoking other programs – user id of a process – Changing the size of a process - Shell – System boot and the INIT process– Process Scheduling-algorithm, scheduling parameters, examples of process scheduling, controlling process priorities, fair scheduler.

6. Memory Management and Inter process Communication: **[8]**

Memory Management Policies: Swapping – Demand paging. Inter process communication, System V IPC (Messages, Shared Memory, Semaphores), Network Communications, Sockets.

BOOKS:

1. Maurice J. Bach, "The Design of the Unix Operating System", Pearson Education.
2. B. Goodheart, J. Cox, "The Magic Garden Explained", Prentice Hall of India.
3. S. J. Leffler, M. K. Mckusick, M. J .Karels and J. S. Quarterman., "The Design and Implementation of the 4.3 BSD Unix Operating System", Addison Wesley.
4. J. Hart, Windows System Programming, Pearson Education, 2008.
5. A. Robbins, Linux Programming by Example: The Fundamentals, Pearson Education, 2008.

CS-104 Digital Image Processing

1. Introduction to Digital Image Processing & Applications [2]
Digital Image Processing.Examples of Use of Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

2. Basic Relationship Between Pixels & Sampling and Quantization [4]
Elements of Visual Perception.Image Sensing and Acquisition.Image Sampling and Quantization. Some Basic Relationships Between Pixels. Linear and Nonlinear Operations.

3. Image Enhancement [8]
Background.Some Basic Gray Level Transformations.Histogram Processing.Enhancement Using Arithmetic/Logic Operations.Basics of Spatial Filtering.Smoothing Spatial Filters.Sharpening Spatial Filters.Combining Spatial Enhancement Methods.
Introduction to the Fourier Transform and the Frequency Domain. Smoothing Frequency-Domain Filters. Sharpening Frequency Domain Filters. Homomorphic Filtering.Implementation.

4. Image Restoration and Transforms [8]
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.Linear, Position-Invariant Degradations.Estimating the Degradation Function.Inverse Filtering.Minimum Mean Square Error (Wiener) Filtering.Constrained Least Squares Filtering.Geometric Mean Filter.Geometric Transformations. Discrete Fourier transform, Walsh transform(WT), Hadamard transform, Cosine transform, Haar transform, Wavelet transform.

5. Color Image Processing. [8]
Color Fundamentals. Color Models. Pseudocolor Image Processing. Basics of Full-Color Image Processing. Color Transformations. Smoothing and Sharpening.

6. Morphological Image Processing & Segmentation [10]
Detection of Discontinuities, Edge linking & Boundary Detection, Thresholding, Region based segmentation Laplacian of Gaussian, Derivative of Gaussian, Canny Edge Detection, Morphological operation : Dilation erosion, Opening & Closing, Basic Morphological Algorithm, Image representation schemes.

7. MATLAB Image processing toolbox [02]
Introduction to MATLAB, matrix operations, introduction to image processing tool box

8. Programming MATLAB [08]
Image read & write, filters (spatial, frequency domain), Image Restoration and Reconstruction, morphological operations, edge detection and linking, segmentation.

Books:
1. Gonzalez & Woods, Digital Image Processing, Pearson Education, Second edition.
2. S.Jayaraman Digital Image Processing TMH (McGraw Hill) publication
3. A.K. Jain, Fundamentals of Image processing, Prentice Hall of India Publication, 1995
4. Gonzalez, Woods & Steven, Digital Image Processing using MATLAB, Pearson Education

CS-Lab-I Lab on Advance OS & Image Processing

Part-I Advanced OS:

1. Use of Unix/Linux – User Commands – Editors - Shell programming
2. C/C++ programming on Unix/Linux – use of make, version control
3. Use of system calls – files – processes – I/O – IPC
4. Experiments using C of mini unix systems (such as Minix) – File system – Processes – Memory Management – Drivers
5. Unix / Linux sources – build, run kernel – small modifications

Part-II DIP
1. Display of Grayscale Images, Color images.
2. Conversion between color spaces.
3. Histogram Equalization.
4. Non-linear Filtering.
5. 2-D DFT and DCT.
6. Filtering in frequency domain.
7. DWT of images.
8. Morphological operation
9. Edge detection using Operators and edge linking
10. Segmentation using thresholding, region based, watersheding .

CS-Lab-II Lab on C++ Programming

Advanced C++ Programming:

1. Design a C++ program that demonstrates language basics such as data types, controls structures, functions, passing parameters to functions, structures etc..
2. Demonstrate virtual functions, virtual destructors, abstract classes and pointer conversions in C++.
3. Demonstrate public, private and protected inheritance and multiple inheritances in C++.
4. Demonstrate exception handling in C++.
5. Demonstrate file handling in C++.
6. Demonstrate function templates, class templates and specialization in C++.
7. Implement a C++ program that demonstrates sequence and associative containers of STL.
8. Write a program to demonstrate generic algorithmsof STL.
9. Implement a C++ program that demonstrates Iterators.
10. Implement a C++ program that demonstrates adaptors of STL.

Semester-II
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CS-201 Advance Java Programming

1. Java Basics Review: **[10]**
Java streams- Text input and output, Reading and writing Binary data, Object serialization; Networking- Socket Programming; Exception Handling, Multithreading; Collection Classes-HashSet , LinkedHashSet ,Stack, LinkedList , ArrayList , Vector ,HashMap, Hashtable, Arrays.

2. Distributed Computing: **[08]**
Remote Method Invocation- Introduction, Architecture, RMI Object services, stub and Skeleton, Steps of developing an RMI system; Overview- IIOP, Interface definition language , CORBA , JINI, JNI.

3. Java Beans and EJB: **[12]**
Java Bean- Concepts, Writing process, Applications, Properties and Events, Property Editors, Customizer , Persistence; Enterprise JavaBeans- Introduction, Specification, Architecture, Container, Types, Life cycle, Applications.

4. Servlets and Java Server Pages: **[12]**
Servlets – Concepts, Architecture, Servlet Container Writing Process, API, Life Cycle, Hierarchy, ServletConfig, ServletContext, Programming and deployment, Servlet and HTML Form, Session Management, JDBC ;
Java Server Pages – Introduction, JSP Tags (Scripting Elements), JSP Containers, Architecture, API, JSP Objects, JSP and JavaBeans, JSP and Servlets.

5. Struts: **[10]**
Introduction, Understanding Scopes, Custom Tags, The MVC Design Pattern, Simple Validation, Processing Business Logic, Basic Struts Tags, Configuring Struts; Introduction-Spring , Hibernate.

Books:

1. Beginning Apache Struts From Novice to Professional, by Arnold Doray by Apress ISBN: 978-1-59059-604-3
2. Professional Hibernate, by Eric Pugh, Joseph D. Gradecki by Wiley Publishing, Inc., ISBN: 0-7645-7677-1
3. Spring In Action, Craig Walls, Ryan Breidenbach, Manning Publishing Co., ISBN: 1-932394-35-4
4. Gary Cornell and Cay S. Horstmann, "Core Java Vol 1 and Vol 2", Sun Microsystems Press, Eight Edition.
5. SoumadipGhosh, "Web Technology with Advanced Java", University Science Press, ISBN:978-93-80856-78-0.

CS-202 Intelligent Systems

1. Introduction: [2]
What is Artificial Intelligence?, The AI Problems, What is an AI Technique, Criteria for Success, AI Task domains, Some General References.

2. Problems, Problem Spaces, and Search: [4]
Defining the Problem as a State Space Search, Production systems, Problem Characteristics, Production System Characteristics, Issues in the Design of Search Programs, Uninformed Search Techniques: DFS and BFS, Additional Problems.

3. Heuristic Search Techniques: [4]
Generate-and- Test, Hill Climbing, Best-First Search, A* Search, AO* Search.

4. Knowledge Representation: [2]
Knowledge Representation Issues, Representations and Mappings, Approaches to knowledge Representation, Issues in Knowledge Representation, The Frame Problem.

5. Using Predicate Logic: [8]
Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution, Natural Deduction.

6. Weak Slot-and-Filler Structures: [3]
Semantic Nets, Frames.

7. Strong Slot-and Filler Structures: [4]
Conceptual Dependency, Scripts.

8. Introduction to Soft Computing: [4]
Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

9. Genetic algorithms [6]
Introduction to Genetic Algorithms (GA) – Applications of GA in Machine Learning - Machine Learning, Approach to Knowledge Acquisition.

10. Neural networks [7]
Machine Learning Using Neural Network, Feed forward Networks – Supervised Learning Neural Networks –Unsupervised Learning Neural Networks, Backpropogation Algorithm.

11. Fuzzy logic [7]
Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

BOOKS:
1. Artificial Intelligence, Elaine Rich, Kevin Knight, Tata McGrawHill.
2. Artificial Intelligence – A modern approach , Stuart Russel, Peter Norwig, Pearosn Education.

CS-203 Compiler Construction

1. **Compiler structure:** analysis-synthesis model of compilation, various phases of a compiler, tool-based approach to compiler construction. [4]

2. **Lexical analysis:** interface with input, parser and symbol table, token,lexeme and patterns. Difficulties in lexical analysis. Error reporting. Implementation. Regular definition, Transition diagrams, LEX. [6]

3. **Syntax analysis:** CFGs, ambiguity, associativity, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence grammars, LR parsers (SLR, LALR, LR), YACC. Syntax directed definitions: inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions. Type checking: type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions. [10]

4. **Run time system:** storage organization, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation. [10]

5. **Intermediate code generation:** intermediate representations, translation of declarations, assignments, control flow, Boolean expressions and procedure calls. Implementation issues. [10]

6. **Code generation and instruction selection:** issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, code generation from dags, peep hole optimization, code generator generators, specifications of machine. [10]

BOOKS:

1. V. Aho, M. Lam, R. Sethi, and J. D. Ullman. Compilers: Principles, Techniques and Tools , PEARSON Education, Second Ed., 2009.

2. C. Fischer and R. LeBlanc.Crafting aCompiler in C, PEARSON Education, 2009.

3. A. C. Holub. Compiler Design in C , PEARSON Education.

4. Kenneth Louden, Compiler Construction: Principles and Practice, Galgotia Publication.

5. David Galles, Modern Compiler Design, Pearson Education, 2009.

CS-204: Design & Analysis of Algorithms

1. Introduction [10]

Euclid's algorithm, Problem, Instance, RAM model, RAM model 2, Asymptotic complexity, Some stylistic issues, Analysis of Algorithms, Principles of Algorithm Design, Heaps and Heap Sort(Insert, Adjust), Set Union and Find, Finding Maximum and
Minimum

2. Divide and conquer [8]

Introduction, Binary Search, Maxmin, Sorting(merge,quick), matrix multiplication

3. Greedy Algorithms [08]

Introduction, single source shortest path, Fractional Knapsack, Huffman Coding , Set of Intervals.

4. Dynamic Programming [08]

Dynamic programming 1: All pair shortest path
DP 2: Knapsack(0/1)
DP 3: Matrix chain multiplication
DP 4: Longest common subsequence
DP 5:A machine scheduling problem

5. Backtracking [06]

Backtracking, constraints, recursive backtrack, queen problem.

6. NP-Completeness [10]

Non deterministic algorithms, searching, sorting, Matching ,P Vs NP, Introduction to NP completeness, Reduction,SAT, CLIQUE.

BOOKS:

1. Fundamentals of Computer Algorithms, Horowitz and Sahni, Galgothia publications.
2. Introduction to the design and analysis of Algorithms, AnanyLevitin : Pearson Education,
3. Design and Analysis of Algorithms, P. Dave, H. Dave, Pearson Education, 2008.
4. Introduction to Algorithms, Cormen, Leiserson and Rivest : Prentice Hall of India

CS-205 Soft Skills Development

1. **Communicative English** [4]
2. **Group Discussions** [4]
3. **How to prepare a good Resume?** [3]
4. **Analytical/Logical Skill Development** [8]
5. **Interview Techniques** [6]

(*If the Resource Person is from the industry then he/she may decide the course content as the requirement*).

No grade will be given for the Soft Skills Development course. However, the completion of the credit for the CS-306 course shall be compulsory.

BOOKS:

1. Cornerstone Developing Soft Skills, Fourth Ed., R. Sherfield, R. Montgomery, P. Moody, Pearson Education, 2010.

CS-Lab-III Lab on DAA and Intelligent Systems

DAA:
1. Write a program to implement removal of recursion for
   • Finding maximum from array
   • Binomial coefficient B(n,m)= B(n-1, m-1)+B(n-1,m), B(n,n)=B(n,0)=1
   • Searching element from array
2. Write a program for creating max./min. heap using
• INSERT
• ADJUST/HEAPIFY
2. Write a program to implement union and find operation.
3. Write a program to find minimum and maximum form a given array.
4. Write a program for searching element form given array using binary search for n=1000,2000,3000 find exact time of execution.
5. Write a program for sorting given array in ascending/descending order with n=1000,2000,3000 find exact time of execution using
• Heap sort
• Merge sort
• Quick sort
6. Write a program for matrix multiplication using Strassen's matrix multiplication.
7. Write a program to find solution of Knapsack instant.
8. Write a program to find shortest path using single source shortest path.
9. Write a program to find shortest path using all pair path.
10. Write a program to find longest common subsequence.
11. Write a program to implement breadth first and depth first search.
12 Write a program to implement breadth first and depth first traversal.
13. Write a program to find all solutions for 8-queen problem using backtracking.
Intelligent Systems: The syllabus of second part of Practical Course (Intelligent Systems) will be prepared before the beginning of the First Semester by the Instructor based on the content of CS-202 Theory course.

CS-Lab-IV Lab on Advance JAVA Programming
1.Write java program(s) that demonstrates Java streams.
2. Implement the Java program(s) for server and client to demonstrate networking in Java using Sockets. (Single server and single client, Single server and multiple clients).
3. Write java program(s) that demonstrates concept of Exceptions.
4. Write java program(s) that demonstrates concept of Multithreading.
5. Write a Java program(s) that demonstrates the use of Collection Classes.
6. Write a Java program(s) that demonstrates the use of RMI technology.
8. Write a Java program(s) that demonstrates Java Bean.
9. Write a Java program(s) that demonstrates EJB.
10. Write a Java program(s) that demonstrates use of Servlets.
11. Write a Java program(s) that demonstrates JSP.
12. Write a Java program(s) that demonstrates the use of struts.

Semester-III

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CS-301 Natural Language Processing

Unit-I [10]

Introduction to NLP, Brief History, Applications: Speech to text, story understanding, QA system, Machine Translation, Text summarization, text classification, sentiment analysis, chatterbox, challenges/Open Problems, Natural Language (NL) Characteristics and NL computing techniques, NL tasks: Segmentation, Chunking, tagging, NER, Parsing, Word Sense Disambiguation, NL Generation, **Web 2.0 Applications** : Sentiment Analysis; Text Entailment; Cross Lingual Information Retrieval (CLIR).

Unit-II [05]

ML basics, algorithms, Naïve Bayes, Bayesian Statistics, HMM, CRF

Unit-III [15]

Word Forms, **POS tagging and Chunking**: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields, POS tagging techniques, Chunking techniques:CRF.

Unit-IV [10]

Structures : Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; dependency parsing; Hybrid of Rule Based and Probabilistic Parsing: MST, MALT parser; Scope Ambiguity and Attachment Ambiguity resolution.

Unit-V [10]

Meaning : Lexical Knowledge Networks, Wordnet Theory; Indian Language Wordnets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors; Coreferences.

Books*:*
1. Allen, James, "Natural Language Understanding", Second Edition,Benjamin/Cumming, 1995.
2. Charniack, Eugene, "Statistical Language Learning", MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, "Speech and Language Processing",Second Edition, Prentice Hall, 2008.
4. Manning, Christopher and Heinrich, Schutze, "Foundations of StatisticalNatural Language Processing", MIT Press, 1999.
5.AksharBharti, VineetChaitanya, Rajeev Sangal,"Natural Language Processing: An Paninian perspective"

CS-302: Data Mining

1. **Data Mining** [6]
   Introduction - Data Mining Functionalities - Classification of Data Mining Systems –Basic Data Mining Task - Data Mining Issues

2. **Data Preprocessing** [8]
   Data Summarization – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

3. **Association Rule Mining** [7]
   Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

4. **Classification and Prediction** [8]
   Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

5. **Cluster Analysis** [8]
   Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

6. **Advanced Techniques** [7]
   Web Mining, Spatial Mining.

7. **Mining Tools** [6]
   Study and use of Weka (Waikato Environment for Knowledge Analysis).

BOOKS:
1. Jiawei Han and MichelineKamber "Data Mining Concepts and Techniques" Second Edition, Elsevier, Reprinted 2008.

2. M. H. Dunham. Data Mining: Introductory and Advanced Topics. Pearson Education. 2001.

3. I. H. Witten and E. Frank. Data Mining: Practical Machine Learning Tools and Techniques. Morgan Kaufmann. 2000.

4. D. Hand, H. Mannila and P. Smyth. Principles of Data Mining. Prentice-Hall. 2001

CS-303 : Programming with Windows Technologies

1. Windows Programming: [16]

Windows environment – a simple windows program – windows and messages – creating the window – displaying the window – message loop – the window procedure – message processing – text output – painting and repainting – Mouse-Keyboard-introduction to GDI – device context – basic drawing – child window controls.

2. Windows Communication Foundation [18]

Windows Communication Foundation Overview, Windows Communication Foundation Concepts, Understanding Windows Communication Foundation, Addresses, Understanding and Programming WCF Binding, Understanding and Programming WCF Contracts, Clients, Services, Security.

3. Windows Presentation Foundation [18]

Overview of Windows Presentation Foundation, WPF and .Net Programming, Anatomy of EPF-Enabled Application, Building a Rich UI with Microsoft Expression Blend, Custom Controls, Security.

Books:
1. Charles Petzold, "Windows Programming", Microsoft press, 1996.
2. Justin Smith,"Inside Windows® Communication Foundation", Microsoft press, ISBN13: 9780735623064.
3. Charles Petzold,"Applications = Code + Markup: A Guide to the Microsoft® Windows® Presentation Foundation" , Microsoft press, ISBN13: 9780735619579, ISBN 10:0-7356-1957-3

CS-304: Internet Computing

The syllabus of this course (CS-304: Internet Computing) will be prepared before the beginning of the third semester by the committee by considering the market requirement, student's feedback and latest technological trends.

CS-305 Seminar

The seminar shall be conducted as per the following depending on the applicability of the subject - Every week there shall be a period for seminar wherein the students have to select the topic, carry out literature survey and prepare seminar report.

No grade will be given for the seminar. However, the completion of the credit for the seminar shall be compulsory.

CS-Lab-V Lab on Windows Technologies

Windows Programming:

1. Write a window program to demonstrate line drawing with left mouse button. The color & width of the line should change with every new line

2. Write a Window Program that displays a small rectangle with every left mouse button. Double Clicking on existing rectangle should erase the rectangle.

3. Write a Window Program to display size of window and no. of left clicks; no. of right clicks and no. of double clicks. The data should be display at the center of the window. Size should be updated when user resizes the window object.

4. Write a Window Program to create filled rectangle and circle. on alternate left click. New figure should not erase the previous one. If user clicks inside any figure a mistake box is display.

5. Write a Window Program to create various brushes and change the background color to brushes on left mouse click.

6. Write a Window program to create a window object. Drag the left mouse buttons & display rectangle for which dragged line is a diagonal. Also demonstrate mouse capturing.

7. Write a window program to Move a ball horizontally inside the client area using timer. At each time lapse the ball should move left of the window and when it touches the left boundary of the window it should go to, the right of the window and so on.

8. Write a window program to display the characters entered by user from the keyboard. [Consider only alphabets and numbers only.

WCF, WWF,WPF

1. Create a simple WCF application with appropriate client and host it in various environments IIS, Windows Service, Windows Application.
2. Create a Sequential Workflow.
3. Create a Conditional Workflow.
4. Create a State Machine Workflow.
5. Create an application using Windows Presentation Foundation.

CS-Lab-VI Lab on Internet Computing & NLP

Internet Computing

The syllabus of this Practical Course part-I CS LAB-VI: Lab on Internet Computing will be prepared before the beginning of the Second Semester by the Instructor based on the content of CS-304 Theory course.

NLP

Detailed lab course on part-II CS LAB-VI: Lab on NLP would be prepared before commencement of the course. NL tasks using NLTK, Standford NL tools should be used.

Semester- IV

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CS-401 Software Engineering

1. Introduction: **[2]**
What is Software Engineering.

2. Software Development Life-cycle: **[6]**
Requirements analysis, software design, coding, testing, maintenance, etc.

3. Software Requirements Specification: **[6]**
Waterfall model, prototyping, interactive enhancement, spiral model. Role of Management in software development.Role of metrics and measurement.

4. Software Requirement Specification: **[6]**
Problem analysis, requirement specification, validation, metrics, monitoring and control.

5. System Design: **[6]**
Problem partitioning, abstraction, top-down and bottom-up design, Structured approach. Functional versus object-oriented approach, design specification and verification metrics, monitoring and control.

6. Coding: **[6]**
Top-down and bottom-up, structured programming, information hiding, programming style, and internal documentation. Verification, Metrics, monitoring and control.

7. Testing: **[6]**
Levels of testing functional testing, structural testing, test plane, test cases specification, reliability assessment.

8. Software Project Management: **[6]**
Cost estimation, Project scheduling, Staffing, Software configuration management, Quality assurance, Project Monitoring, Risk management, etc.

9. Web Engineering: **[6]**

The attribute of Web based application, The WebE Process, Framework for WebE Design and Testing for Web based application.

BOOKS:

1. Software Engineering : A Practitioner's Approach, Roger S Pressman 7thEdition McGraw Hill International Publication.

2. The Complete Reference : Web Design, Thomas A Powell. McGraw Hill International Publication.

CS-402: Current Computing Trends

The syllabus of this course (CS-402: Current Computing Trends) will be prepared before the beginning of the fourth semester by the committee by considering the market requirement, student's feedback and latest technological trends.

CS-403 Optimization Algorithms

1. Overview of operations Research: [2]
OR models – OR Techniques

2. **Linear Programming:** [8]
Introduction – Graphical solution; Graphical sensitivity analysis– The standard form of linear programming problems – Basic feasible solutions -unrestricted variables – simplex algorithm – artificial variables – Big M and two phase method – Degeneracy - alternative optima – unbounded solutions – infeasible solutions.

3. **Dual problems:** [8]
Relation between primal and dual problems – Dual simplex method

4. **Transportation model:** [8]
Starting solutions. North West corner Rule - lowest cost method–Vogels approximation method – Transportation algorithms –Assignment problem –Hungarian Method.

5. **Network Models :** [6]
Definitions – CPM and PERT – Their Algorithms

6. **Integer Programming:** [6]
Branch and Bound Algorithms cutting plan algorithm, Dynamic Programming, Recursive nature of dynamic programming – Forward and Backward Recursion

7. **Deterministic Inventory Models :** [6]
Static EOQ Models – Dynamic EOQ models.

8. **Game theory:** [6]
Two person Zero Sum Games – Mixed strategy games and their algorithms.

BOOKS:
1. Operations Research – An Introduction, Handy A Taha – Pearson Education.
2. Operations Research, PanneerSelvan, Prentice Hall of India

CS-404 Project

Project course will commence at the beginning of fourth semester at the school of Computer Sciences and the final work along with report will be submitted to the school at the end of fourth semester. Project viva will be conducted for final evaluation.

CS-Lab-VII Lab on Current Computing Trends

Current Computing Trends: The syllabus of this Practical Course (CS LAB-VII: Lab on Current Computing Trends) will be prepared before the beginning of the fourth semester by the Instructor based on the content of CS-404 Theory course.