Vidyasagar University

Curriculum for B.Sc. (Honours) in Computer Science [Choice Based Credit System]

Semester-V

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
CC- 11		C11T: Advanced Java	Core Course-11	4	0	0	6	75
		- Lab		0	0	4		
CC- 12		C12T: Theory of Computation	Core Course-12	5	1	0	6	75
DSE-1		TBD	Discipline Specific Electives -1	5/4	1/0	0/4	6	75
DSE-2		TBD	Discipline Specific Electives -2	5/4	1/0	0/4	6	75
Semester Total							24	300

L= Lecture, **T=** Tutorial, **P =** Practical, **CC -** Core Course, **TBD -** To be decided, **DSE:** Discipline Specific Elective.

Semester-V

List of Core Course (CC)

CC-11: Advanced Java
CC-12: Theory of Computation

Discipline Specific Electives (DSE)

DSE-1: Information Security
Or
DSE-1: Microprocessor
Or
DSE-1: Operational Research
Or
DSE-1: Cloud Computing

DSE-2: Network Programming
Or
DSE-2: Computational Linguistics
Or
DSE-2: Machine Learning

Core Courses (CC)

CC-11: Advanced Java — Credits 06

C11T: Advanced Java — Credits 04

Course Contents:

Java

Use of Objects, Array and Array List class

JavaScript

Data types, operators, functions, control structures, events and event handling.

JDBC

JDBC Fundamentals, Establishing Connectivity and working with connection interface, working with statements, Creating and Executing SQL Statements, Working with Result Set Objects.

JSP

Introduction to Java Server Pages, HTTP and Servlet Basics, The Problem with Servlets, The Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Displaying Values, Using an expression to Set an Attribute, Declaring Variables and Methods, Error Handling and Debugging, Sharing Data Between JSP Pages, Requests, and Users, Database Access.

Java Beans

Java Beans Fundamentals, JAR files, Introspection, Developing a simple Bean, Connecting to DB.

Suggested Readings:

1. Ivan Bayross, Web Enabled Commercial Application Development Using Html, Dhtml, java script, Perl Cgi , BPB Publications, 2009.
2. Cay Horstmann, BIG Java, Wiley Publication, 3rd Edition. 2009
3. Herbert Schildt, Java 7, the Complete Reference, 8th Edition, 2009.
4. Jim Keogh, The Complete Reference J2EE, TMH, 2002.
5. O' Reilly, Java Server Pages, Hans Bergsten, Third Edition, 2003.

C11P: Advanced Java (Lab) — Credits 02

Practical:

1. HTML to Servlet Applications
2. Applet to Servlet Communication
3. Designing online applications with JSP
4. Creating JSP program using JavaBeans
5. Working with Enterprise JavaBeans
6. Performing Java Database Connectivity.
7. Creating Web services with RMI.
8. Creating and Sending Email with Java
9. Building web applications

CC-12: Theory of Computation Credits 06

C12T: Theory of Computation

Course Contents:

1. **Languages**

Alphabets, string, language, Basic Operations on language, Concatenation, KleeneStar

2. Finite Automata and Regular Languages

Regular Expressions, Transition Graphs, Deterministics and non-deterministic finite automata, NFA to DFA Conversion, Regular languages and their relationship with finite automata, Pumping lemma and closure properties of regular languages.

3. Context free languages

Context free grammars, parse trees, ambiguities in grammars and languages, Pushdown automata (Deterministic and Non-deterministic), Pumping Lemma, Properties of context free languages, normal forms.

4. Turing Machines and Models of Computations

RAM, Turing Machine as a model of computation, Universal Turing Machine, Language acceptability, decidability, halting problem, Recursively enumerable and recursive language unsolvability problems.

Suggested Readings:

1. Daniel I.A.Cohen, Introduction to computer theory, John Wiley,1996

2. Lewis & Papadimitriou, Elements of the theory of computation , PHI 1997.

3. Hoperoft, Aho, Ullman, Introduction to Automata theory, Language & Computation,3rd Edition, Pearson Education. 2006

4. P. Linz, An Introduction to Formal Language and Automata 4th edition Publication Jone Bartlett, 2006

Discipline Specific Elective (DSE)

DSE-1: Information Security — Credits 06

DSE-1T: Information Security — Credits 04

Course Contents:

1. Introduction

Security, Attacks, Security Services, Security Mechanisms.

2. Cryptography

Substitution ciphers, Transpositions Cipher, Symmetric, Asymmetric Encryption. DES Modes of DES and DES , Uses of Encryption, Hash function, key exchange, Digital Signatures, Digital Certificates.

3. Program Security

Secure programs, Malicious codes, virus, Trap doors, Salami attacks, Covert channels,

4. Threats.

Protection in OS: Memory and Address Protection, Access control, File Protection, User Authentication.

5. Database Security

Requirements, Reliability, Integrity, Sensitive data, Inference, Multilevel Security.

6. Security in Networks

Threats in Networks, Security Controls, firewalls, Intrusion detection systems, Secure e-mails

7. Administrating Security

Security Planning, Risk Analysis, Organisational Security Policy, Physical Security. Ethical issues in Security: Protecting Programs and data. Information and law.

Suggested Readings:

1. C. P. Pfleeger, S. L. Pfleeger; Security in Computing, Prentice Hall of India, 2006
2. W. Stallings; Network Security Essentials: Applications and Standards, 4/E, 2010

DSE1P: Information Security (Lab) **Credits 02**

Practical:

1. Demonstrate the use of Network tools: ping, ipconfig, ifconfig, tracert, arp, netstat, whois.
2. Use of Password cracking tools : John the Ripper, Ophcrack. Verify the strength of passwords using these tools.
3. Perform encryption and decryption of Caesar cipher. Write a script for performing these operations.
4. Perform encryption and decryption of a Rail fence cipher. Write a script for performing these operations.
5. Use nmap/zenmap to analyse a remote machine.
6. Use Burp proxy to capture and modify the message.
7. Demonstrate sending of a protected word document.
8. Demonstrate sending of a digitally signed document.
9. Demonstrate sending of a protected worksheet.
10. Demonstrate use of steganography tools.
11. Demonstrate use of gpg utility for signing and encrypting purposes.

Or

DSE-1: Microprocessor - 8085 Credits 06

DSE-1T: Microprocessor - 8085 **Credits 04**

Course Contents:

Microprocessor architecture:

Internal architecture, system bus architecture, memory and I/O interfaces.

Microprocessor programming:

Register Organization, instruction formats, assembly language programming.

Interfacing:

Memory address decoding, I/O interface, keyboard, display, timer, interrupt controller, DMA controller, video controllers, communication interfaces.

Suggested Readings:

1. Barry B. Brey : The Intel Microprocessors : Architecture, Programming and Interfacing. Pearson Education, Sixth Edition,2009.
2. Walter A Triebel, Avtar Singh; The 8088 and 8086 Microprocessors Programming, Interfacing, Software, Hardware, and Applications. PHI, Fourth Edition 2005.

DSE1P: Microprocessor (Lab) **Credits 02**

Assembly Language Programming

1. Write a program for 32-bit binary division and multiplication
2. Write a program for 32-bit BCD addition and subtraction
3. Write a program for linear search and binary search.
4. Write a program to add and subtract two arrays
5. Write a program for binary to ascii conversion
6. Write a program for ascii to binary conversion
7. To write an ALP program to display the keyboard status using 8086.
8. To write an ALP program for displaying the Digital clock.
9. To write and implement the program for stepper motor using 8085
10. To write a program to Print RAM size and system date using 8086.
11. To write an ALP program for password checking using 8086.
12. To write a Program using 8086 for Copying 12 Bytes of Data from Source to Destination & Verify.
13. To search the character in a string using 8086
14. To sort the given number in ascending order using 8086.
15. To convert a given binary to BCD.
16. To write an assembly language program to convert an 8 bit binary data to BCD using 8085 microprocessor kit.

Or

DSE-1: Operational Research — Credits 06

DSE-1T: Operational Research — Credits 04

Course Contents:

Introduction to Operational Research (OR):

Origin & Development, Different Phases of OR study, Methodology of OR, Scope and Limitations of OR, Applications of OR.

Linear Programming:

Linearly independent / dependent vectors, Basis, Convex sets, Extreme points. Graphical method. Simplex method, Artificial variable techniques- Two Phase Method; M-Charnes Method, Special cases in LPP.

Duality:

Definition of the dual problem, Primal-dual relationships, Economic Interpretation of Duality, Dual simplex Method.

Sensitivity analysis:

Changes in cost and resource vector

Suggested Readings:

1. G. Hadley: Linear Programming. Narosa, 2002 (Reprint).
2. A. Ravindran, D. T. Phillips and James J. Solberg: Operations Research-Principles and Practice, John Wiley & Sons, 2005.
3. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 8th Edition, 2008.
4. F.S. Hillier. G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata McGraw Hill. 2010.

DSE1P: Operational Research (Lab) — Credits 02

Practical:

[1] To solve Linear Programming Problem using Graphical

Method with Unbounded solution
Infeasible solution
Alternative or multiple solutions.

[2] Solution of LPP with simplex method.
[3] Problem solving using M-Charnes method.
[4] Problem solving using Two Phase method.
[5] Illustration of following special cases in LPP using Simplex method
Unrestricted variables
Unbounded solution
Infeasible solution
Alternative or multiple solution
[6] Problems based on Dual simplex method.
[7] Problems based on sensitivity analysis.

Or

DSE-1: Cloud Computing — Credits 06

DSE1T: Cloud Computing — Credits 04

Course Contents:

Overview of Computing Paradigm

Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing,

Introduction to Cloud Computing

Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Benefits and limitations of Cloud Computing,

Cloud Computing Architecture

Comparison with traditional computing architecture (client/server), Services provided at various levels, Service Models- Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), How Cloud Computing Works, Deployment Models- Public cloud, Private cloud, Hybrid cloud, Community cloud, Case study of NIST architecture.

Case Studies

Case study of Service model using Google App Engine, Microsoft Azure, Amazon EC2 , Eucalyptus.

Service Management in Cloud computing

Service Level Agreements (SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling.

Cloud Security

Infrastructure Security- Network level security, Host level security, Application level security, Data security and Storage- Data privacy and security Issues, Jurisdictional issues raised by Data location, Authentication in cloud computing.

Suggested Readings:

1. *Cloud Computing Bible,* Barrie Sosinsky, *Wiley-India*, 2010
2. *Cloud Computing: Principles and Paradigms,* Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, *Wile*, 2011
3. *Cloud Computing: Principles, Systems and Applications, Editors:* Nikos Antonopoulos, Lee Gillam, *Springer*, 2012
4. *Cloud Security: A Comprehensive Guide to Secure Cloud Computing*, Ronald L. Krutz, Russell Dean Vines, *Wiley-India,* 2010
5. Gautam Shroff, *Enterprise Cloud Computing Technology Architecture Applications* , Adobe Reader ebooks available from e-Books.com,2010
6. Toby Velte, Anthony Velte, Robert Elsenpeter, *Cloud Computing, A Practical Approach* ,McGraw Hills, 2010.
7. Dimitris N. Chorafas, *Cloud Computing Strategies* , CRC Press, 2010

DSE1P: Cloud Computing (Lab) **Credits 02**

1. Create virtual machines that access different programs on same platform.
2. Create virtual machines that access different programs on different platforms.
3. Working on tools used in cloud computing online-
    a) Storage
    b) Sharing of data
    c) Manage your calendar, to-do lists,
    d) A document editing tool
4. Exploring Google cloud
5. Exploring microsoft cloud

6. Exploring amazon cloud

DSE-2: Network Programming — Credits 06

DSE-2T: Network Programming — Credits 04

Course Contents:

Transport Layer Protocols: TCP, UDP, SCTP protocol.

Socket Programming: Socket Introduction; TCP Sockets; TCP Client/Server Example ; signal handling; I/O multiplexing using sockets; Socket Options; UDP Sockets; UDP client server example; Address lookup using sockets.

Network Applications: Remote logging; Email; WWW and HTTP.
LAN administration: Linux and TCP/IP networking: Network Management and Debugging.

Suggested Readings:

1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Unix Network Programming, The sockets Networking API, Vol. 1, 3rd Edition, PHI.2003
2. B. A. Forouzan**:** Data Communications and Networking, Fourth edition**,** THM Publishing Company Ltd.,2003
3. Nemeth Synder & Hein, Linux Administration Handbook, Pearson Education, 2nd Edition,2010
4. R. Stevens, Unix Network Programming, PHI 2nd Edition,1990

DSE2P: Network Programming (Lab) — Credits 02

Practical:
Practical exercises based on concepts listed in theory.

Or

DSE-2: Computational Linguistics — Credits 06

DSE2T: Computational Linguistics — Credits 04

Course Contents:

Introduction Computers in linguistics and Natural Language Processing The nature and use of text corpora.
Introduction to python programming and NLTK, Regular expressions Pattern matching Corpus search and counting.
Regular languages Finite-state automata Operations and closure properties Pumping Lemma, Finite-state linguistics Transducers Morphological analysis.
N-grams Language modelling Smoothing Evaluation.
Part-of-Speech Tagging, Word classes and tagsets Rule-based and stochastic POS tagging Hidden Markov Models Evaluation.
Word meaning Semantic ambiguity Semantic relations Semantic roles.
Computational lexical semantics, (Un) supervised word sense disambiguation Classifiers Vector-space semantics.

Suggested Readings:

1. Jurafsky, D. and J. H. Martin, Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition (2nd Edition). Prentice-Hall, 2008.
2. Charniak, E.: Statistical Language Learning. The MIT Press. 1996.
3. J. Allen: Natural Language Understanding. Benjamin/Cummins.1995.40

DSE2P: Computational Linguistics Lab **Credits 02**

Practical:

Practical exercises based on concepts listed in theory.

Or

DSE-2: Machine Learning **Credits 06**

DSE2T: Machine Learning **Credits 04**

Theory:

Introduction:
Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier.

Software for Machine Learning and Linear Algebra Overview:
Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using available tool such as MATLAB.

Linear Regression:

Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling/Selection.

Logistic Regression:
Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables.

Regularization:
Regularization and its utility: The problem of Over fitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance.

Neural Networks:
Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Backpropagation Algorithm.

Suggested Books:

1. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.
2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

DSE2P: Machine Learning (Lab) **Credits 02**

Practical:

For practical Labs for Machine Learning, students may use software like MABLAB/Octave or Python. For later exercises, students can create/use their own datasets or utilize datasets from online repositories like UCI Machine Learning Repository (http://archive.ics.uci.edu/ml/).

1. Perform elementary mathematical operations in Octave/MATLAB like addition, multiplication, division and exponentiation.

2. Perform elementary logical operations in Octave/MATLAB (like OR, AND, Checking for Equality, NOT, XOR).

3. Create, initialize and display simple variables and simple strings and use simple formatting for variable.

4. Create/Define single dimension / multi-dimension arrays, and arrays with specific values like array of all ones, all zeros, array with random values within a range, or a diagonal matrix.

5. Use command to compute the size of a matrix, size/length of a particular row/column, load data from a text file, store matrix data to a text file, finding out variables and their features in the current scope.

6. Perform basic operations on matrices (like addition, subtraction, multiplication) and display specific rows or columns of the matrix.

7. Perform other matrix operations like converting matrix data to absolute values, taking the negative of matrix values, additing/removing rows/columns from a matrix, finding the maximum or minimum values in a matrix or in a row/column, and finding the sum of some/all elements in a matrix.

8. Create various type of plots/charts like histograms, plot based on sine/cosine function based on data from a matrix. Further label different axes in a plot and data in a plot.

9. Generate different subplots from a given plot and color plot data.

10. Use conditional statements and different type of loops based on simple example/s.

11. Perform vectorized implementation of simple matrix operation like finding the transpose of a matrix, adding, subtracting or multiplying two matrices.

12. Implement Linear Regression problem. For example, based on a dataset comprising of existing set of prices and area/size of the houses, predict the estimated price of a given house.

13. Based on multiple features/variables perform Linear Regression. For example, based on a number of additional features like number of bedrooms, servant room, number of balconies, number of houses of years a house has been built – predict the price of a house.

14. Implement a classification/ logistic regression problem. For example based on different features of student's data, classify, whether a student is suitable for a particular activity. Based on the available dataset, a student can also implement another classification problem like checking whether an email is spam or not.

15. Use some function for regularization of dataset based on problem 14.

16. Use some function for neural networks, like Stochastic Gradient Descent or back propagation - algorithm to predict the value of a variable based on the dataset of problem 14.