# Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE

**(AUTONOMOUS)**
**VYASARPADI, CHENNAI – 600 039**

## MINUTES OF THE MEETING OF BOARD OF STUDIES - M.Phil - COMPUTER SCIENCE

Meeting of the Board of Studies in Computer Science [for revising the M.Phil Computer Science course syllabus] was held on 11-06-2019 (Tuesday) at 1.00 P.M at the Department of Computer Science of this College.

- The syllabus is revised as per University of Madras norms.
- This syllabus is approved and it is with effect from the academic year 2019-20.

| S.No. | Members Present | Signature |
|---|---|---|
| 1 | **Dr. A. Murugan** – **Chairman**<br>Associate Professor & HOD of Computer Science<br>Dr. Ambedkar Government Arts College (Autonomous)<br>Vyasarpadi, Chennai – 600 039 | |
| 2 | **Dr. Sornam** – **University Nominee**<br>Professor of Computer Science<br>University of Madras, Chennai – 600 108. | |
| 3 | **Dr. Vidya Priya** – **College Nominee (External)**<br>Associate Professor, PG & Research department of Computer Science<br>Quaid-e-millath College for Women, Chennai. | |
| 4 | **Dr J Senthil Kumar** – **College Nominee (External)**<br>Assistant Professor<br>Govt. Arts College, Perumbakkam, Chennai. | |
| 5 | **Dr. (Mrs.) K. Shyamala** – **Member**<br>Associate Professor of Computer Science<br>Dr. Ambedkar Government Arts College (Autonomous)<br>Vyasarpadi, Chennai – 600 039 | 11/06/19 |
| 6 | **Mr. K. Radhakrishnan** – **Member**<br>Assistant Professor of Computer Science<br>Dr. Ambedkar Government Arts College (Autonomous)<br>Vyasarpadi, Chennai – 600 039 | 11/6/19 |
| 7 | **Mrs. N.Vanitha** – **Member**<br>Assistant Professor of Computer Science<br>Dr. Ambedkar Government Arts College (Autonomous)<br>Vyasarpadi, Chennai – 600 039 | |
| 8 | **Mrs. B.Jayapradha** – **Member**<br>Assistant Professor of Computer Science<br>Dr. Ambedkar Government Arts College (Autonomous)<br>Vyasarpadi, Chennai – 600 039 | 11/6/19 |

| | | |
|---|---|---|
| 9 | **Dr. G.Sekar** – **Member**<br>Assistant Professor of Computer Science<br>Dr. Ambedkar Government Arts College (Autonomous)<br>Vyasarpadi, Chennai – 600 039 | |
| 10 | **Dr. Behin Sam** – **Member**<br>Assistant Professor of Computer Science<br>Dr. Ambedkar Government Arts College (Autonomous)<br>Vyasarpadi, Chennai – 600 039 | |
| 11 | **Mr. Krishna Kumar** – **Member**<br>Assistant Professor of Computer Science<br>Dr. Ambedkar Government Arts College (Autonomous)<br>Vyasarpadi, Chennai – 600 039 | |
| 12 | **Mr Suresh Thangavel**, **-Industrialist**<br>Information Security Manager<br>Tata Consultancy Services,<br>Thoraipakkam<br>Chennai 97 | |
| 13 | **Mr Vasantha Raj**, **- Alumni**<br>Assistant Professor of Computer Science,<br>Muthukumarasamy College,<br>Kodungaiyur, Chennai – 118. | |

# DR. AMBEDKAR GOVT. ARTS COLLEGE,

## DEPARTMENT OF COMPUTER SCIENCE

**M. Phil – COMPUTER SCIENCE**
**[With the effect from 2019-20 onwards]**

### 1. OBJECTIVE OF THE PROGRAMME

It is a pre-research degree in Computer Science for Post Graduate in Computer Science/Computer Applications/Information Technology or any other equivalent programme recognized by University of Madras. The aim of the course is to explore the various research areas in Computer Science and Applications.

### 2. ELIGIBILITY

The minimum marks for admission to Full-Time M.Phil Degree course shall be 50% for the candidates who have qualified for the Master's Degree in Computer Science/Computer Applications/Information Technology or any other equivalent programme recognized by University of Madras, prior to 01-01-1991 and 55% for the candidates who have qualified for the Master's degree on or after 01-01-1991. There is no provision for rounding off of 54.5% and above marks to 55%. For candidates belong to SC/ST Community and Disabled(Physically and Visually challenged) candidates, who have qualified for a Master's Degree on or after 01-01-1991, a concession of 5% of marks will be given in the minimum eligibility marks prescribed.

The conditions for admission prescribed under regulations in respect of M.Phil. Degree course should be strictly followed. All candidates should have passed two year P.G. Degree course after three year Degree course and Higher Secondary of 12 years duration or Pre-University under 11 year S.S.L.C +1 year or 10+2 Pattern. Candidates who have passed the P.G. Degree Examination with less than 17 years of total duration of the course are not eligible for admission to M.Phil degree course.

Eligibility certificate should be obtained from the Registrar of Madras University, before giving admission to the candidates who have passed their qualifying examination from other Boards/Universities.

*The selection of the candidates to the M.Phil degree in Computer Science is as per the reservation of Government of Tamil Nadu.*

### 2.1 FULL-TIME M.PHIL COURSE:

The admission may be made on the basis of the marks obtained by the candidates in qualifying examination and marks scored in the Entrance Test. The Entrance Test may be conducted on the following lines:-

- The Entrance Test must be conducted for a maximum of 100 marks in respect of Full-Time M.Phil candidates only. No Entrance Examination need to be held for Part-Time M.Phil.
- The Entrance Test should be held after the publication of P.G. results.
- The Entrance Test will be for 50 marks and the remaining marks will be for the qualifying examination in the subject concerned.
- In the case of candidates of University of Madras including those from autonomous colleges of this University both Internal and External marks have to be taken into account.
- In the case of candidates who have obtained their P.G. Degree from other Universities, the marks secured by them in the External Examination plus Entrance Test marks have to be taken into consideration to arrive the merit list.
- The Entrance Test has to be conducted by the Department of Computer Science.
- The Department concerned may design the question paper for the Entrance Test. The question paper has to be set and valued by the concerned department only.

## 2.2 PART-TIME M.PHIL COURSE:

(i) Teacher candidates working in affiliated colleges and whose qualifications/appointments are approved by the University.
(ii) Teacher candidates working in the University Departments.
(iii) Teacher candidates working in Polytechnic approved by the Director of Technical Education or in Higher Secondary School and High Schools approved by the State Board or Central Board of Secondary Education or Education Instructors of I.A.F.(within Madras University area) who possess Master's Degree.

Preference should be given to teachers working in the Colleges affiliated to this University and in the Departments of this University. Then teachers working in Polytechnics approved by the Directorate of Technical Education and in approved Higher Secondary Schools as well as High schools under State Board or Central Board and Education Instructors of I.A.F.(within Madras University area) may be considered on merit basis, subject to reservation rules of the Government of Tamil Nadu.

**It may be noted that only teachers whose appointment has been approved by the competent Authority should be selected.**

**Category of Candidates Competent Authority**

| | |
|---|---|
| i) College Teachers: | University of Madras |
| ii)Teachers working in Polytechnics : | Director of Technical Education |
| iii)Teachers working in the Hr.Sec./High Schools : | D.E.O./Inspector of Matriculation Schools/Inspector of Anglo Indian Schools/ Secretary, CBSE etc. |

**The teacher candidates working at a reasonable distance (i.e.) the distance between the place of employment and the College where M.Phil, is conducted should be such that the candidates can travel every day and attend classes regularly on working days after finishing their teaching assignment may be selected.**
**While selecting the Part-time candidates, the following should also be verified:-**

- The applications of the candidates should have been routed through the proper channel.
- The appointment of the candidates should have been approved by the Competent Authority.
- The candidates should have enclosed the Service Certificate along with the application form.
- The candidates should have enclosed the Certificate from the D.T.E./D.E.O that the Polytechnic/Higher Secondary /High School where the teachers are employed is recognized by the Government.

**3. DURATION**

The M. Phil – Full Time Programme spans over a period of one year from the commencement of the programme comprising of two semesters.
The duration of M.Phil - Part-Time programme shall extend over a period of two academic years. Maximum period for completion (including extension period) of the M.Phil programme is two years in the case of Full-time candidates and three years in the case of Part-time candidates.

**4. COURSE OF STUDY**

There are three courses for semester I and Dissertation and viva voce for semester II. The third course in the first semester shall be a **specialization related to the Dissertation.** The student in consultation with the research supervisor must select the third course.

**5. SCHEME OF EXAMINATIONS**

| Courses | Credits | Hours of Examination |
|---|---|---|
| **PAPER I - RESEARCH METHODOLOGY** | 6 | 3 Hours |
| **PAPER II - ADVANCED COMPUTING TECHNIQUES** | 6 | 3 Hours |
| **PAPER III - ELECTIVE** | 6 | 3 Hours |
| Dissertation and Viva-Voce | 18 | - |

Total of 36 credits

**6. PASSING MINIMUM**

A Candidate shall be declared to have passed if he/she secures not less than 50% of the marks in each course.

**7. RESTRICTION IN NUMBER OF CHANCES**

As per the University norms.

**8. CONFERMENT OF DEGREE:**

No Candidate shall be Eligible for conferment of the M.Phil Degree unless he/she is declared to have passed all the courses of the Examination as per the Regulations.

**Classification of Successful Candidates**

As per the University norms

**9. ELIGIBILITY FOR RESEARCH SUPERVISORS CONDUCTING THE M.PHIL PROGRAMME**

As per the regulations of University of Madras.

**10. NUMBER OF CANDIDATES UNDER A SUPERVISOR**

As per the University of Madras norms

**11. ATTENDANCE**

a) Candidate admitted to M.Phil. Full-time programme shall secure 75% attendance during the entire course, including short-term training programme, workshop, seminar, conference, etc. attended by them outside the College on the recommendation of the guide and with prior permission of the Head of the Department. The attendance may be calculated year-wise. b) The Principal of affiliated college shall have the power to condone 10% of shortage of attendance and the condonation may be granted on the merit of the case. It cannot be claimed as a matter of right. c) The Part-time candidates shall report to the guide at least thirty days in each year. This period may include holidays also. d) Attendance for M.Phil part-time candidates shall be maintained by the respective guides and submitted to the HOD once in six months. e) The Part-time candidates shall take part in Departmental Seminars at least twice in a year. f) If there is a shortage in attendance, due to availing of leave on medical grounds, the candidate's minimum period of research shall be extended accordingly, within the prescribed maximum period.

**12. SCHEME OF EXAMINATION**

**A) PART I – WRITTEN EXAMINATION**

i) The candidates are required to appear for the written examination under Part-I of the programme, at the end of six months after joining the course in the case of Full-time candidates and at the end of one year after registration, in the case of Part-time candidates.

ii) The written examinations will normally be conducted twice in a calendar year in the months of March/April or October/November.

iii) The duration and the maximum marks for each written paper are 3 hours and 100 marks respectively.

The Examination for specialization course will be conducted by the controller of examination along with courses I and II. Two different sets of question papers should be sent to the controller of examinations for specialization course by the respective research supervisors and one question paper will be selected from the Controller office.

The question paper pattern for M.Phil Part I - Written Examination

**For each Course other than the Dissertation**
Continuous Internal Assessment – 40 Marks
End Semester Examination – 60 Marks
Total – 100 Marks

**Question paper pattern for Course I - III**
5 questions out of 6 05 x 04 = 20 Marks
4 questions from 6 04 x 10 = 40 Marks (at least one question from each unit)
Total 60 Marks

**CIA components**
Tests (2x10) - 20 Marks
Term Paper – 10 Marks
Seminar - 10 Marks

**B) PART II - DISSERTATION**
The candidates shall be permitted to submit their dissertation only after successful completion of Part-I examinations. The candidates shall be required to submit four copies of the dissertation, under Part-II after 12 months from the month of admission in the case of Full-time candidates and 24 months from the month of admission in the case of Part-time candidates. However, in exceptional cases, extension of time for submission of M.Phil dissertation will be granted up to a maximum period of one year, on payment of the fees prescribed from time to time.

The supervisor should submit a panel of four examiners along with the dissertation for the evaluation of dissertation and to conduct the viva voce. The respective supervisors shall be an internal examiner. The viva board should consist of the research supervisor, head of the department and external examiner.

The Examiners who value the Dissertation shall report on the merit of Candidates as “Highly Commended”(75% and Above) or “Commended” (50% and Above and Below 75%) or “Not Commended” (Below 50%).
In case, the dissertation is assessed as “Not Commended”, or recommended by the examiner for “revision and re-submission”, the candidate will be permitted to resubmit his / her dissertation on a second occasion within a period of six months from the date of announcement of the result.
No candidate will normally be permitted to resubmit the dissertation on more than one occasion.
Submission or re-submission of the dissertation will be allowed twice a year.

A candidate shall be declared to have qualified for M.Phil degree if he / she pass both Part I and Part II of the programme.

All the requirements for the award of M.Phil degree shall be completed within a total period of two years from the date of admission in the case of Full-time programme and within a period of three years from the date of admission, in the case of Part-time programme.

**CIA components for Dissertation**
Two reviews must be conducted in the department 2 x 20 = 40, before the submission of the dissertation.

**End Semester Exam**
Paper Presentation – 20
Viva Voce – 40
Dissertation – 100

Total – 200 Marks

**FORMAT OF THE DISSERTATION**
The dissertation should be of the following format:

1. Front Wrapper Cover Page
   Title, Name of the Candidate (Enrolment No.), Name of the Guide, College Name (with emblem) and Place, Month and Year of submission.
2. Title Page
   (As in Sl. No. 1 just above)
3. Declaration of the Student
   Refer Annexure
4. Certificate of the Guide
   Refer Annexure
5. Acknowledgements
   The candidate may thank all those who helped in the preparation of dissertation.
6. Table of Contents
   In standard format.
7. List of Tables
   Tables, if any, with Table No., Title of the Table and Page No. be given table-wise. The source of table be given at the bottom. (Refer the specimen).
8. List of Figures
   Similar to List of tables.
9. Main Body of the Dissertation
   The main body of the dissertation may be divided into 4 to 5 Chapters with suitable title for each Chapter. The last chapter shall be invariably conclusion.
   The total number of pages of the Dissertation may be between 100 and 150 pages.
10. Reference Section
    After all Chapters are presented, Appendices are included.
    Appendix I: Copy of the Questionnaire or Schedule (Give full copy of the Questionnaire or Schedule)
    Appendix II: Bibliography (Give full list of Books, Reports, Journals and Newspapers referred in alphabetical order of authors under respective headings)

**TYPING AND BINDING**
1. The dissertation material should be neatly computerized in ***double space, on one side*** and in ***A4 size Bond Paper*** only. Times New Roman 14 or Arial 12 font be used.
2. The dissertation must be ***Card-board Bound*** with Laminated Wrapper Sheet. (Spiral binding and other forms of binding will not be accepted).

3. The dissertation in ***Four Copies*** must be prepared. One to the COE Office, One to the College Library, one for the Guide and one for the Candidate.
4. ***Two Copies*** of dissertation duly forwarded by the Guide must be submitted for the viva voce examination.

## DECLARATION

I ……..hereby declare that the dissertation, entitled "…….……" submitted to the Dr. Ambedkar Government College, under University of Madras, in partial fulfillment of the requirements for the award of the Degree of Master of Philosophy in Computer Science is a record of original research work done by me during…….…….under the supervision and guidance of Dr/Mr.…… ……..…….……. Department of **Computer Science** and it has not formed the basis for the award of any Degree / Diploma / Associate ship / Fellowship or other similar title to any candidate in any University.

**Signature of the Candidate**

**Countersigned**
**(Research Supervisor)**

## CERTIFICATE

This is to certify that the dissertation, entitled "…… ……..……..……" submitted to Dr. Ambedkar Government College, under University of Madras, in partial fulfillment of the requirements for the award of the Degree of Master of Philosophy in **Computer Scienc**e is a record of original research work done by Mr./Ms…….. during the period ……..of his /her study in the Department of **Computer Science** at Dr. Ambedkar Government College, under my supervision and guidance and the dissertation has not formed the basis for the award of any Degree / Diploma / Associate ship / Fellowship or other similar title to any candidate of any University.

**Countersigned** **Signature of the Guide**
Head of the Department

## LIST OF TABLES



*Note:* In the table numbers given, the first one indicates the Chapter number and the second number following the dot refers the number of the table in that Chapter. Similar approach has to be followed for List of Figures also.

**M. Phil. / Ph.D. – COMPUTER SCIENCE**
**Part I – Syllabus [From 2019 – 2020 batch onwards]**

PAPER I: **RESEARCH METHODOLOGY** **- 19MACSC1**
PAPER II: **ADVANCED COMPUTING TECHNIQUES** **- 19MACSC2**
PAPER III:

| Sl.No | Paper Code | Title |
|---|---|---|
| 1 | 19MACSE1A | ADVANCED NETWORKING |
| 2 | 19MACSE1B | BIOINFORMATICS ALGORITHMS |
| 3 | 19MACSE1C | DATA WAREHOUSING AND MINING |
| 4 | 19MACSE1D | NATURAL LANGUAGE PROCESSING |
| 5 | 19MACSE1E | PARALLEL PROGRAMMING |
| 6 | 19MACSE1F | AGENT BASED COMPUTING |
| 7 | 19MACSE1G | INFORMATION SECURITY |
| 8 | 19MACSE1H | CLOUD COMPUTING |
| 9 | 19MACSE1I | DISTRIBUTED COMPUTING |
| 10 | 19MACSE1J | ARTIFICIAL NEURAL NETWORKS |
| 11 | 19MACSE1K | WEB ENGINEERING |
| 12 | 19MACSE1L | SOFTWARE TESTING AND QUALITY ASSURANCE |

## PAPER I: RESEARCH METHODOLOGY

**UNIT – I RESEARCH METHODS** Meaning of Research- Objectives of Research- Motivation in Research- Types of Research- Research Approaches- Significance of Research-research methods versus Methodology-Research and Scientific Method- Importance of Knowing How Research is done- Research Process –Criteria of good Research –Problem Encountered by Researchers in India- What is Research Problem? Selecting the Problem- Necessity of Defining the Problem- Technique involved in Defining the Problem.

**UNIT – II REPORT WRITING** Meaning of Research Design- Need for Research Design- Features of a Good Design- Important Concepts Relating to Research Design- Different research design- Basic principles of Experimental Designs- Significance of Report Writing- Different Steps in writing Report- Layout of the Research Report- Types of Reports- Oral Presentation Mechanics of Writing a Research Report- Precautions for Writing Research Reports.

**UNIT – III ALGORITHMS AND ANALYSIS** Elementary data Structures, Greedy method: Knapsack problem-job sequencing with deadlines, Dynamic Programming: Multistage graphs-0/1 knapsack- Reliability design- The traveling salesperson problem, Basics search and traversal techniques: The techniques Code Optimization- Bi-connected components and depth- first search. Backtracking: The 8-Queers problem- Sum of subsets –Hamiltonian cycles.

**UNIT – V LATEX** Basics – input files, structures, command line session- layout of the document. Typesetting text – space between words – titles, chapters and sections, cross references footnotes, emphasized words, environments, floating bodies – Typesetting mathematical formulae – specialties – producing mathematical graphics – Figures, Tables, BibTeX.

**UNIT – IV R PROGRAMMING** Introduction – R Objects- Reading and Writing data – Interfaces to outside world – Sub setting R objects – Control Structures – Functions – Loop functions – Simulation – Debugging – Statistical applications.

**TEXT BOOKS**

**UNIT - I & II**

1. C.R.Kothari,"Research Methodology Methods & Techniques" 2nd Edition, Wishwa Prakashan Publishers.

2. Dr.Rajammal P. Devadas,"A. Handbook on Methodology of Research-Sri Ramakrishna Mission Vidyalaya College of Rural Higher Education".

**UNIT – III**

1. Alfre V. Aho, John E. Hcpcroft, Jeffrey D. Ullman," Data structures and Algorithms", Addison-Wesley Publishing Company, 1987.

2. Ellis Harowitz, Sartaj Sahini, "Compute Algorithms", Galgotia Publications (P) Ltd., 1993.

**UNIT - IV**

1. Leslie Lamport, LaTeX: A Document Preparation System, Second Edition.

2. F. Mittelbach and M. Goossens,The LATEX Companion, 2nd. ed. Addison Wesley, 2004

**UNIT - V**

1. Roger D Peng, "R Programming for Data Science", Lean Publishing, 2015.

2. Andrie de Vries and Joris Meys "R for Dummies " John Wiley & Sons Ltd. 2012

## PAPER II: ADVANCED COMPUTING TECHNIQUES

**UNIT – I DIGITAL IMAGE PROCESSING -** Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement. **Image Restoration** – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters; Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation - Image compression and recognition.

**UNIT – II SOFT COMPUTING** Introduction: Soft Computing Constituents – Soft Computing Vs Hard Computing – Characteristics – Applications.
Introduction to Fuzzy logic, Fuzzy membership functions, Operations on Fuzzy sets. Fuzzy relations, Fuzzy proposition, Fuzzy implications, Fuzzy inferences.
Genetic Algorithm: Fundamental Concept – Basic Terminologies – Traditional Vs Genetic Algorithm - Elements of GA - Encoding - Fitness Function – Genetic Operators: Selection – Cross Over - Inversion and Deletion - Mutation – Simple and General GA – The Schema Theorem - Classification of Genetic Algorithm – Genetic Programming – Applications of GA.

**UNIT – III Web Mining** :Information Retrieval and Web Search - Information Retrieval Models - Text and Web Page Pre-Processing - Inverted Index and Its Compression - Latent Semantic Indexing- Meta-Search - Web Spamming
**Social Network Analysis** – Page Rank Algorithms – HITS - Community Discovery
**Web Crawling** - A Basic Crawler Algorithm - Implementation Issues- Universal Crawlers - Topical Crawlers.

**UNIT - IV SECURITY** Security problems in Computing – Cryptography – Program security – Database security – Security in Networks.

**UNIT - V GRID COMPUTING** Grid Computing organization and their role – Grid computing anatomy – Merging the Grid service architecture with web services architecture.

**TEXT BOOKS:**

**UNIT - I**. Rafael Gonzalez, Richard E. Woods, “Digital Image Processing”, Fourth Edition, PHI/Pearson Education, 2013
**UNIT - II** S.N. Sivanandam, S.N. Deepa, “Principles of Soft Computing”, Wiley India, 2007.
**UNIT - III** Bing Liu, "Web Data Mining - Exploring Hyperlinks, Contents, and Usage Data" Second Edition, Springer-Verlag Berlin Heidelberg, 2007. (Chapter 6, 7, 8)
**UNIT – IV** Charles P. Pfleeger, & Shani Lawrence Pfeeger, “Security in Computing, “(Chapter 1,2,3,6 & 7)
**UNIT – V** Joshy Joseph and Graig Felenstern “Grid Computing” – Pearsons 2004.

## (A) ADVANCED NETWORKING

**UNIT - I**

Interconnections: Digital Data Communication Techniques – Data Link control protocol – Multiplexing – Spread spectrum – Circuit switching and packet switching – routing in switched networks. Data Link Layer issues – Transparent and Source routing bridges – Network interface – generic connectionless service – network layer address – connectionless data packet formats – routing algorithm concepts – Fast packet forwarding.

**UNIT - II**

Frame relay – ATM – High- speed LANs - Congestion control in data networks and Internets – Link-level flow and error control – TCP traffic control – Integrated and differential services – protocols for Qos support.

**UNIT - III**

VPN - SDH and SONET networks – Operational aspects – evolution of the optical network – optical transport network. Network Management: SNMP Basic Foundation – SNMPv2 – SNMPv3 –RMON.

**UNIT - IV**

Mobile Communication: Wireless Transmission – Medium Access Control – Telecommunication Systems – Broadcast Systems - Wireless LAN – Mobile IP. Adhoc Wireless Networks: Adhoc Wireless Networks – MAC Protocol – Routing Protocols – Multicast Routing - QOS – Wireless Sensor Networks – Energy Management.

**UNIT - V**

Network Security and System Security: Introduction to Network Security – Symmetric Encryption and Message Confidentiality – Public-key Cryptography and Message Authentication – Authentication Application – Electronic Mail Security – IP Security – Web Security – Network Management Security - Intruders – Malicious Software – Firewalls.

**TEXT BOOKS**

1. Jochen Schiller, Mobile Communication, Pearson, 2nd Edition, 2009.
2. C.Siva Ram Murthy, B.S. Manoj, “Adhoc Wireless Networks”, Pearson, 2005.
3. Radia Perlman, “Interconnections”, Pearsons, 2000.
4. William Stallings, “High Speed Networks and Internets”, Pearson, 2010.
5. Jon C.Snader,” VPNs Illustrated Tunnels, VPNs and Ipsec”, Pearson, 2006.
6. Jean Pjilippe Vasseur, Mario Pickavet, Demeester, “Network Recovery”, Elsevier, 2004.
7. Mani Subramanian, “Network Management”, Pearson, 2006.
8. William Stallings, “Data and Computer Communications”, Pearson, 2007

## (B) BIOINFORMATICS ALGORITHMS

### UNIT I: INTRODUCTION

Algorithms and Complexity- Biological algorithms versus computer algorithms – The change problem –Correct versus Incorrect Algorithms – Recursive Algorithms – Iterative versus Recursive Algorithms – Big-O Notations – Algorithm Design Techniques.

### UNIT II: GREEDY ALGORITHMS

Molecular Biology Primer – Exhaustive Search – Mapping Algorithms – Motif-Search Trees – Finding Motifs – Finding a Median String – Greedy Algorithm – Genome Rearrangements – Sorting by Reversals – Approximation Algorithms – A Greedy Approach to Motif Finding.

### UNIT III: DYNAMIC PROGRAMMING ALGORITHMS

DNA Sequence comparison – Manhattan Tourist Problem – Edit Distance and Alignments – Longest Commons Subsequences – Global Sequence Alignment – Scoring Alignment – Local Sequence Alignment – Alignment with Gap Penalties – Multiple Alignment-Gene Predictions – Approaches to Gene Prediction - Spiced Alignment – Divide and Conquer Algorithms.

### UNIT IV: GRAPH ALGORITHMS

Graphs – Graphs and Genetics – DNA Sequencing – Shortest Superstring Problem – DNA arrays as an alternative sequencing techniques – Sequencing by Hybridization – Path Problems – Fragment assembly in DNA Sequencing – Protein Sequencing and Identification – The Peptide Sequencing Problem – Spectrum Graphs – Spectral Convolution and Alignment – Combinatorial Patter matching.

### UNIT V: CLUSTERING AND TREES

Clustering and trees – Gene expression analysis – Hierarchical clustering-k-means clustering – Clustering and corrupted Cliques – Evolutionary Trees – Distance-based tree reconstruction – Reconstruction trees from additive matrices – Evolutionary trees and hierarchical clustering – Character-based tree reconstruction – Small and large Parsimony Problem – Hidden Markov Models-Randomized Algorithms.

### TEXTBOOKS

1. Neil C. Jones and Pavel A. Pevzner, An Introduction to Bioinformatics Algorithms, MIT Press, First Indian Reprint 2005.

2. Gary Benson Roderic page (Eds), Algorithms in Bioinformatics, Springer International Edition, First Indian Reprint 2004.

### REFERENCE BOOKS

1. Gusfields G, Algorithms on strings, trees and sequences- Computer Science and Computational Biology, Cambridge University Press 1997.

2. Steffen Schulze-Kremer, Molecular Bioinformatics: Algorithms and Applications, Walter de Gruyter, 1996.

## (C) DATA WAREHOUSING AND MINING

**UNIT - I**

Data Warehousing Introduction – Definition-Architecture-Warehouse Schema-Warehouse server-OLAP operations. Data Warehouse technology – Hardware and operating system- Warehousing Software – Extraction tools – Transformation tools – Data quality tools – Data loaders – Data Access and retrieval tools – Data Modeling tools – Fact tables and dimensions Data warehousing case studies : Data warehousing in Government, Tourism, Industry and Genomics data.

**UNIT – II**

Data Mining definition – DM Techniques – current trends in data mining - Different forms of Knowledge – Data selection, cleaning, Integration, Transformation, Reduction and Enrichment. Data: Types of data - Data Quality - Data Preprocessing - Measures of similarity and dissimilarity. Exploration: Summary statistics – Visualization.

**UNIT – III**

Association rules: Introduction – Methods to discover association rule – Apriori algorithm Partition Algorithm – Pincher search algorithm – Dynamic Item set algorithm – FP Tree growth algorithm. Classification: Decision Tree classification – Bayesian Classification – Classification by Back Propagation.

**UNIT - IV**

Clustering Techniques: Introduction – Clustering Paradigms – Partitioning Algorithms – K means & K Mediod algorithms – CLARA – CLARANS – Hierarchical clustering – DBSCAN – BIRCH – Categorical Clustering algorithms – STIRR – ROCK – CACTUS. Introduction to machine learning – Supervised learning – Unsupervised learning – Machine learning and data mining. Neural Networks: Introduction – Use of NN – Working of NN Genetic Algorithm: Introduction –Working of GA.

**UNIT - V**

Web Mining: Introduction –Web content mining – Web structure mining –Web usage mining –Text mining –Text clustering, Temporal mining -Spatial mining –Visual data mining – Knowledge mining – Various tools and techniques for implementation using (Weka, Rapidminer and Matlab).

**TEXT BOOKS**

1. Arun K Pujari , “Data Mining Techniques”, University press , Edition 2001.
2. Jaiwei Han, Michelinne Kamber , “Data Mining : Concepts and Techniques”
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, “Introduction to Data Mining”, 2007.
4. T.Sushmita mitra, Tir ku Acharaya , “Data Mining Multimedia,Softcomputing & Bioinformatics”, Wiley Interscience publications , 2004.
5. Michal J A Berry, Gordon Linoff, “Mastering Data Mining”, John Wiley & Sons, 2000.
6. Alex Berson , Stephen J.Smith , “Data Warehousing , Data Mining & OLAP “, Tata McGrawhill
7. C S R Prabhu, “Data Warehousing – concepts, techniques and applications “, 2nd Edition, Prentice Hall of India, 2002

## (D) NATURAL LANGUAGE PROCESSING

**UNIT I**

Natural Language Processing (NLP) - open problems - major goal - language structure - language analyzer - morphological analyzer - local world grouper (LWG) - core parser - requirements of computational grammars - computational aspect - system aspect - large system aspect - morphological analysis - morphological generation using paradigms - morphological analysis using paradigms - speeding up morphological analysis by compilation - morphological analyzer - additional issues - local word grouping - verb groups - noun groups - strategy for grammar development - semantics in stages.

**UNIT II**

Paninian grammar - semantic model - free word order and vibhakti - paninian theory - karaka relations - active passive - control - karaka to vibhakti mapping - karaka sharing.

**UNIT III**

Machine translation - survey - is MT possible? - Possible approaches - current status - anusaraka or language processor - cutting the Gordian knot - structure of anusaraka systems - user interface - linguistic area - anusaraka output - language bridges.

**UNIT IV**

Lexical functional grammar - active passive and dative constructions - WH movements in questions - LFG formalism - well formedness conditions - handling WH movements in questions - computational aspects - features and feature structures - unification - other constraints - CFG and Indian languages functional specification - lexicalized grammars and locality - lexicalized tree substitution grammar - lexicalized tree adjoining grammar - feature structures - mathematical aspects.

**UNIT V**

Comparing TAG with PG - similarities between TAG and PG - differences between TAG and PG - Government and binding - GB modules - X-bar theory - theta theory - Government - Case theory - bounding theory - empty category principle (ECP) - binding theory - constraints on movement - GB parsing - comparing GB with PG.

**REFERENCE BOOKS**

1. Akshar Bharati, Vineet Chaitanya, Rajeev Sangal, “Natural Language Processing - A Paninian Prespective”, Prentice Hall of India, 2000

2. James Allen, Natural Language Understanding, Pearson Education, 3rd edt., 2005

3. D. Jurafsky and J. Martin, *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*, 2nd Edition, Prentice Hall, 2008.

4. C. Manning and H. Schutze, *Foundations of Statistical Natural Language Processing*”, MIT

## (E) PARALLEL PROGRAMMING

**UNIT I FUNDAMENTALS OF PARALLEL COMPUTING**

Need for Parallel Computing – Parallel Computer Models – ILP, TLP and Data Parallelism – Parallel Programming Overview – Processes, Tasks and Threads – Parallel Programming Models – Shared Memory Programming – Message Passing Paradigm – Interaction and Communication – Interconnection Networks.

**UNIT II CHALLENGES OF PARALLEL PROGRAMMING**

Identifying Potential Parallelism – Techniques for Parallelizing Programs – Issues – Cache Coherence issues – Memory Consistency Models – Maintaining Memory Consistency – Synchronization Issues – Performance Considerations.

**UNIT III SHARED MEMORY MODELS AND OPENMP PROGRAMMING**

OpenMP Execution Model – Memory Model and Consistency – Open MP Directives – Run Time Library Routines – Handling Data and Functional Parallelism – Performance Considerations.

**UNIT IV MPI PROGRAMMING**

The MPI Programming Model – MPI Basics – Circuit Satisfiability – Global Operations – Asynchronous Communication – Collective Communication – Other MPI Features – Performance Issues – Combining OpenMP and MPI.

**UNIT V PROGRAMMING HETEROGENEOUS PROCESSORS**

GPU Architecture – Basics of CUDA – CUDA Threads – CUDA Memories – Synchronization Handling – Performance Issues – Application Development. Introduction to OpenCL.

**TEXT BOOKS**

1. John L. Hennessey and David A. Patterson, “Computer Architecture – A quantitative approach”, Morgan Kaufmann / Elsevier Publishers, 5th. Edition, 2012.
2. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann, 2011.
3. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.
4. David B. Kirk and Wen-mei W. Hwu, “Programming Massively Parallel Processors”, Morgan Kaufmann, 2010.

**REFERENCES**

1. Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, “Introduction to Parallel Computing”, Second Edition, Pearson Education Limited, 2003.
2. Ian Foster, “Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering”, Addison Wesley Longman Publishing Co., USA, 1995.
4. David E. Culler, Jaswinder Pal Singh, “Parallel Computing Architecture: A hardware/ Software approach”, Morgan Kaufmann / Elsevier Publishers, 1999.
5. OpenMP Programmer’s Manual.
6. MPI Programmer’s Manual

## (F) AGENT BASED COMPUTING

**UNIT - I** Introduction to Software Agents: What is a software agent? - Why software agents? - Applications of Intelligent software agents-Practical design of intelligent agent systems.

**UNIT - II** Intelligent Agent Learning- Approaches to Knowledge base development-Disciple approach for building intelligent agents- Knowledge representation-Generalization-Problem solving methods-Knowledge elicitation.

**UNIT - III** Rule learning: Rule learning problem- Rule learning method- Learned rule characterization. Rule refinement: Rule refinement problem- Rule refinement method- Rule experimentation and verification-Refined rule characterization-Agent interactions.

**UNIT - IV** Disciple shell: Architecture of Disciple shell- Methodology for building Intelligent Agents- Expert-Agent interactions during knowledge elicitation process- Expert-Agent interactions during rule learning process- Expert-Agent interactions during rule refinement process.

**UNIT - V** Case studies in building intelligent agents: Intelligent Agents in portfolio management-Intelligent Agents in financial services. Java Agent Development framework [JADE]: Creating multi-agent systems with JADE- Agent platform- Agent Tasks and behaviors-Agent Communication Language - Interaction protocols- Using JADE from Java.

**TEXT BOOKS**

1. Jeffrey M Bradshaw, “Software Agents”, AAAI Press/ The MIT Press, 2000.
2. Nicholas R Jennings, Michael J Wooldridge (Eds.), “Agent Technology – Foundations, Applications and Markets”, Springer, 1997.
3. Gheorghe Tecuci et al., “Building Intelligent Agents”, Academic Press, 2003.
4. Eduardo Alanso, Daniel Kudenko, Dimitar Kazakov (Eds.), “Adaptive Agents and Multi-Agent Systems”, Springer Publications, 2003.

## (G) INFORMATION SECURITY

**UNIT - I** Conventional Encryption : Classical Technique – Modern technique – Algorithms; Public Key Cryptography : Public Key Cryptography – Introduction to Number Theory – Message Authentication and Hash Function – HASH and MAC Algorithm – Digital Signature and Authentication protocol.

**UNIT - II** Network Security Practice: Authentication Application – Electronic Mail Security – IP Security Program Security and System Security: Secure programs – Non-malicious program errors – viruses and Worms – Memory and address protection – control access to general objects – File protection mechanism – user authentication – Trusted operating system design and assurance – Intrusion Detection system.

**UNIT – III** System Security and Web Security: Intruders,– Firewall - Managing Access – Password management - Web Security requirements – SSL and TLS – SET; Client Side Security : Using SSL – Active Content – Web Privacy. Database Security: The Database as a Networked Server – Securing database-to-database communication – Reliability and Integrity of database – sensitive data – inference – multilevel databases

**UNIT - IV** Wireless Network Security: Mobile Security – Encryption Schemes in WLANs – Basic approach to WLAN security and Policy Development – WLAN intrusion process – WLAN security solutions. Digital Watermarking and Steganography: Models of Watermarking – Basic Message Coding – Watermark Security – Content Authentication – Steganography.

**UNIT - V** Cyber Crimes: Introduction – computer crime and cyber crimes; Classification of cyber crimes, Cyber crime and Related Concepts: Distinction between cyber crime and conventional crimes, Reasons for commission of cyber crime, Cyber forensic : Cyber criminals and their objectives, Kinds of cyber crimes – cyber stalking; cyber pornography; forgery and fraud; crime related to IPRs; Cyber terrorism; computer vandalism, Regulation of cyber crimes: Issues relating to investigation, Issues relating to Jurisdiction, Issues relating to Evidence , Relevant provisions under Information Technology Act, 2000, Indian Penal Code, Pornography Act and Evidence Act etc.

**TEXT BOOKS**

1. Charrles P. Pfleeger, Shari Lawrence Pfleegner, “Security in Computing”, Prentice Hall of India, 2007.
2. William Stallings, “Cryptography and Network Security”, 5th Edition, Pearson.
3. John W.Rittinghouse, James F.Ransome, “Wireless Operaional Security”, Elsevier, 2004.
4. Ron Ben Natan,”Implementing Database Security and Auditing”, Elsevier, 2005.
5. Lincoln D. Stein, “Web Security”, Addison Wesley, 1999.
6. Ingemar J.Cox, Matthew L. Miller Jeffrey A.Bloom, Jessica Fridrich,Ton Kalker,“Digital Watermarking and Steganography”, 2nd Edition, Elsevier.
7. Dr.R.K.Tiwari, P.K.Sastri, K.V.Ravikumar, “ Computer Crime and computer Forensics”, 1st Edition, Selective Publishers, 2002.

## (H) CLOUD COMPUTING

**UNIT I - BASICS**

What is Cloud Computing – Types of Clouds – Private Cloud- Public Cloud- Community Cloud – Hybrid Cloud - Understanding Cloud Architecture – Understanding Cloud Storage – Understanding Cloud Services.

**UNIT II - READY FOR CLOUD**

Pros and Cons of Cloud Service Development – Who Benefits from Cloud – Who should not use the cloud - Types of Cloud Service Development – Software as a Service – Platform as a Service – Infrastructure as a Service.

**UNIT III - SECURITY ISSUES**

Data Security – Network Security – Host Security – Disaster Recovery Planning – Disasters in the Cloud – Disaster Management.

**UNIT IV - VIRTUALIZATION**

Virtualization and the Cloud – Characteristics - Using a Hypervisor in virtualization – Abstracting hardware assets – Foundation issues – Abstraction layer – Provisioning software – Virtualization Storage – Hardware Provisioning.

**UNIT V - CASE STUDIES**

Amazon Web Services (IaaS), Google (SaaS, Paas).

**REFERENCE BOOKS**

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
2. Cloud Application Architectures - George Reese –O'Reilly
3. Cloud Computing for Dummies – Judith Hurwitz, Robin Bloor, Marcia Kaufman, Dr. Fern Halper
4. Cloud Security and Privacy – Tim Mather, Subra Kumaraswamy and Shahed Latif - O'Reilly

## (I) DISTRIBUTED COMPUTING

**UNIT - I:** Hardware Concepts - Switched Multiprocessor - Bus-based multicomputer - Switched Multicomputer - Software concepts - Network Operating Systems and NFS - Time Distributed Systems. Design Issues: Transparency - Flexibility - Reliability - Performance and scalability.

**UNIT - II:** Communications in distribute systems - The Client/Server Model - Blocking versus unbuffered primitives - Implementation of Client/Server model.

**UNIT - III:** Synchronization in distributed systems - Clock synchronization - Mutual exclusion - Election algorithms - Atomic transactions - Dead lock distributed system - Threads - Thread usage and implementation of thread packages - Processor allocation.

**UNIT - IV:** Distributed File System: File Service interface - Semantics of file sharing - Distributed file system - Implementation of new trends in distributed file system.

**UNIT - V:** Distributed databases: Distributed DBMS Architecture - Sorting Data in a Distributed DBMS - Distributed Catalog Management - Distributed query processing - Updating distributed data - Distributed transaction management - Distributed Concurrency control - Recovery.

### TEXTBOOKS

1. A.S. Tanenbaum - Modern Operating Systems - Prentice Hall.

### REFERENCE BOOKS

1.Sape Mullender," Distributed Systems", Addison Wesley, Second Edition, 1993.
2.Albert Fleishman," Distributes Systems- Software Design and Implementation", Springer-Verlag, 1994.
3.M.L.Liu, "Distributed Computing Principles and Applications", Pearson Education, 2004.
4. Andrew S Tanenbaum , Maartenvan Steen, "Distibuted Systems –Principles and Pardigms", Pearson Education, 2002.
5. Mugesh Singhal,Niranjan G Shivaratri, "Advanced Concepts in Operating Systems", Tata McGraw Hill Edition, 2001 .

## (J) ARTIFICIAL NEURAL NETWORKS

**UNIT I:** Introduction to Neural Networks – Basic Concepts of Neural Networks– Inference and Learning – Classification Models – Association Models –Optimization Models – Self-Organization Models.

**UNIT II :** Supervised and Unsupervised Learning – Statistical Learning – AI Learning – Neural Network Learning – Rule Based Neural Networks – Network Training – Network Revision-Issues- Theory of Revision- Decision Tree Based NN – Constraint Based NN

**UNIT III :** Incremental learning – Mathematical Modeling – Application of NN Knowledge based Approaches.

**UNIT IV :** Heuristics- Hierarchical Models – Hybrid Models – Parallel Models –Differentiation Models- Control Networks – Symbolic Methods- NN Methods.

**UNIT V :** Structures and Sequences – Spatio-temporal NN – Learning Procedures- Knowledge based Approaches.

**TEXT BOOK**

(i) L. Fu, 1994, Neural Networks in Computer Intelligence, Tata McGraw Hill, New Delhi.

**REFERENCE BOOKS**

(i) R. J. Schalkoff, 1997, Artificial Neural Networks, Tata McGraw Hill, New Delhi.

(ii) Anderson, 2001, An Introduction to Neural Network, PHI, New Delhi.

## (K) WEB ENGINEERING

**UNIT I**

**The need for Web Engineering:** Introduction – Web Applications versus Conventional Software – The need for Web Engineering Approach – Empirical Assessment

**UNIT II**

**Web Effort Estimation:** Introduction – Effort Estimation Techniques – Measuring Effort Prediction Power & Accuracy – Which is the most Accurate Prediction Technique – Case Study

**UNIT III**

**Web Productivity Measurement and Benchmarking:** Introduction – Productivity Measurement Method – Case Study.

**UNIT IV**

**Web Quality:** Introduction – Different Perspectives of Quality – Evaluating Web Quality using WebQEM – Case Study

**UNIT V**

**Web Usability:** Principles and Evaluation Methods - Introduction – Defining Web Usability – Web Usability Criteria – Evaluation Methods – Automatic Tools to Support Evaluations – Evaluation of the DEI Application.

**REFERENCE BOOKS**

1. **Web Engineering** – Emilia Mendes, Nile Mosley (Eds) – Springer.
2. **Web Engineering: The Discipline of Systematic Development of Web Applications** – Gerti Kappel, Birgit Proll, Siegfried Reich, Werner Retschitzegger – John Wiley & Sons Ltd 2006.

## `(L) SOFTWARE TESTING AND QUALITY ASSURANCE

**UNIT - I** Introduction to software quality – Software modeling – Scope of the software quality program – Establishing quality goals – Purpose, quality of goals – SQA planning software – Productivity and documentation, Software quality assurance plan – Purpose and Scope, Software quality assurance management - Organization – Quality tasks – Responsibilities – Documentation. Standards, Practices, Conventions and Metrics, Reviews and Audits – Management, Technical review – Software inspection process – Walk through process – Audit process – Test processes – ISO, CMM compatibility – Problem reporting and corrective action.

**UNIT – II** Tools, Techniques and methodologies, Code control, Media control, Supplier control, Records collection, Maintenance and retention, Training and risk management. ISO 9000 model, CMM model, Comparisons, ISO 9000 weaknesses, CMM weaknesses, SPICE – Software Process Improvement and Capability determination.

**UNIT – III** Purpose of Software testing – Some Dichotomies – a model for testing – Playing pool and consulting oracles – Is complete testing possible – The Consequence of bugs Taxonomy of Bugs. Software testing Fundamentals – Test case Design – Introduction of Black Box Testing and White Box testing – Flow Graphs and Path testing – Path testing Basics - Predicates, Path Predicates and Achievable Paths - Path Sensitizing – Path Instrumentation –Implementation and Application of Path Testing.

**UNIT - IV** Transaction Flow testing – Transaction Flows – techniques – Implementation Comments – Data Flow Testing – Basics – Strategies – Applications, Tools and effectiveness – Syntax Testing – Why, What, How – Grammar for formats – Implementation – Tips.

Logic Based Testing – Motivational Overview – Decision tables – Path Expressions –
KV Charts – Specifications – States, State Graphs and transition Testing – State Graphs – Good & bad states – state testing Metrics and Complexity.

**UNIT - V** Testing GUIs – Testing Client – Server Architecture – Testing for Real-time System – A Strategic Approach to Software testing – issues – unit testing – Integration Testing –Validation testing – System testing – The art of Debugging.

**REFERENCE BOOKS**

1. Mordechai Ben – Meachem and Garry S.Marliss, “Software Quality–Producing Practical, Consistent Software”, International Thompson Computer Press, 1997
2. Watt. S. Humphrey, “Managing Software Process”, Addison – Wesley, 1998.
3. Philip.B.Crosby,“Quality is Free:The Art of making quality certain”, Mass Market, 1992
4. Boris Beizer, Software Testing Techniques, Dreamtech Press, Second Edition 2003.
5. Myers and Glenford.J., The Art of Software Testing, John-Wiley & Sons,1979
6. Roger.S.Pressman, Software Engineering – A Practitioner’s Approach ,Mc-Graw Hill, 5th edition, 2001
7. Marnie.L. Hutcheson, Software Testing Fundamentals, Wiley-India, 2007.