# Dr. Babasaheb Ambedkar Marathwada Univeristy

## Aurangabad

## Department of Computer Science & Information Technology

Reaccredited with 'A' Grade

# CURRICULUM BOOK

# M.PHIL COMPUTER SCIENCE

# 2016-2018

OBE Curriculum with w.e.f. Academic Year 2017-2018

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD**

**DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY**

Syllabus Book of

# M.Phil. (Computer Science)

**Faculty of Science and Technology**

W.E.F. ACADEMIC YEAR JUNE, 2016-18

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**
Department of Computer Science and Information Technology

# Choice Based Credit System (CBCS)
# M.Phil. Computer Science
**(2016-2018)**

## SCHEME FOR CHOICE BASED CREDIT SYSTEM (CBCS)
**W.E.F. JUNE, 2016 (ACADEMIC YEAR, 2016-18 Onwards)**

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## M.Phil. (Computer Science) 2016-18


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**About the Revised Syllabus**

- This version came into effect in June 2016. There have been many advancements in Computer Science and Information Technology and consequent changes in needs of society, industry in respect in which the syllabus was required to be updated.
- This document present the revised version of M.Phil. Computer Science syllabus which becomes effective for teaching with immediate effect. It is designed to facilitate students in the development of research based approach for problem solving using IT as a tool. The self-learning approach is built in the syllabus thereby training the candidate to update themselves on the changing technologies in their area of work. The outstanding syllabus has been designed to produce educationist and research scholars.

**About Admission Procedure**

The course is designed to motivate technical ability through research perspective. Research work/dissertation work would be carried out under the guidance of the highly qualified teachers in the Department. To get research training for simplification of Ph. D. work.

**Eligibility**

**Admission/ Promotion in M.Phil. Computer Science Program: M.Phil.**

**Duration:** (Three Semesters means one and half Academic Years)

**Intake:** 20

**Eligibility:**

M. Phil course in Computer Science under the faculty of Science will be governed by following rules:

- The degree of M.Phil. shall be conferred on a candidate who has satisfied the following conditions.
- He must have taken M. Sc. in Computer Science or M. Sc. Information Technology or MCA Engineering and Technology or Science Faculty or M.E./M. Tech. in Computer Science and Engineering or Information Technology Degree with at least 55% marks and 50% for the reserve category. Candidates of this University or of any other statutory University where the grading system is prevalent he should have passed the degree in equivalent cumulative Grade Point Average.

**Admission Criteria**

**a) Common Entrance Test**

Those students who are seeking admission to M.phil. in Computer Science in the Department have to go through the CET Examination.

**b) CET Syllabus**

The objective type questions will be set for CET examination. The subjects are: Operating System, Data Structure, Microprocessor, Compiler Design, Computer Graphics, C++, DBMS, Discrete Mathematical Structure, Computer System Architecture and Software Engineering.

**c) CET Exam Pattern**

a. Marks 50 Objective with no negative marking.
b. Time One Hour

**d) Evaluation: The merit list will be prepared as per the following procedure**

| Sr. No | Name of Examination | Marks |
|---|---|---|
| 1. | CET | 50 |
| 2. | B.Sc. | 20 |
| 3. | M.Sc. | 30 |
| Total | | 100 |

**A. Marks from B.Sc. will be considered as follows:**

| Sr. No | Percentage | Marks |
|---|---|---|
| 1. | 45 – 49.9 | 10 |
| 2. | 50 – 59.9 | 15 |
| 3. | Above 60 | 20 |

**B. Marks from M.Sc. will be considered as follows:**

| Sr. No | Percentage | Marks |
|---|---|---|
| 1. | 50 – 54.9 | 10 |
| 2. | 55 – 59.9 | 20 |
| 3. | Above 60 | 30 |

**C. Marks obtained in CET**

***Merit List Will be prepared by considering the marks from A+ B+C***

**Credit Based System**

Department of Computer Science and Information Technology adopted a credit-based system under the Academic Flexibility Program of the University from the academic year 2016-17.

It is a flexible, cafeteria-type learning system with an inbuilt horizontal mobility for students to all desire UNITs of education in the Department/Departments with provision for even inter Departmental mobility for students. CBCS operates on modular pattern based on module/UNITs called "credits", wherein 'credit' defines the quantum of contents/syllabus prepared for a course/paper and determines the minimum number of teaching-learning hours required.

CBCS permits students to: I) Learn at their own pace, II) Choose electives from a wide range of elective courses offered by the department, III) Undergo additional/value added courses and acquire more than the required number of credits, depending upon the learner aptitude, IV) Adopt an interdisciplinary approach in learning, V) Make best use of the expertise of faculty across the Department, beside the particular department faculty and VI) Acquire knowledge, skill and attitude of learning outcomes through participatory teaching and learning and continuous evaluation process.

This provides the flexibility to make the system more responsive to the changing needs of our students, the professionals and society. The credit-based system also facilitates the transfer of credits.

**Credits and Degrees**

(i) A candidate who has successfully completed all the core courses, Elective/ Specialized courses and, seminars and project prescribed and or optional service courses approved by the University for the program with prescribed CGPA shall be eligible to receive the degree.

(ii)One Credit shall mean one teaching period of one hour per week for one semester (of 15 weeks) for theory courses and two practical/laboratory/field/ demonstration hours/ week for one semester.

(iii) Every student will have to complete at least 100 credits to obtain the master's degree of M. Sc. Computer Science/ M. Sc. Information Technology (Post graduate degree) out of which 96 credits should be from this Department and four or eight credits of service courses from this or other Department. However the Department can design the curriculum of more credits and it will be compulsory for the students of this Department to complete the credits accordingly.

**Courses**

(i) **Core Course:** - A core course is a course that a student admitted to M. Sc. Computer Science/ M. Sc. Information Technology program must successfully complete to receive the degree. Normally no theory course shall have more than 4 credits.

(ii)**Elective Course:** Means a optional course from the basic subject or specialization.

(iii) **Service course (SC):** The service courses will be offered in third and fourth semesters in the department. Student should complete one service course in each semester.

(iv) Each Course shall include lectures / tutorials / laboratory or field work / Seminar / Practical training / Assignments / mid-term and term end examinations/ paper / Report writing or review of literature and any other innovative practice etc., to meet effective teaching and learning needs.

(v)**Attendance:** - Students must have 75% of attendance in each Core and Elective course for appearing the examination. However student having 65% attendance with medical certificate may apply to the H.O.D. for commendation of attendance.

**Departmental Committee:**

Every P.G. program of the University/College shall be monitored by a committee constituted for this purpose by the Department. The Committee shall consist of H.O.D. as a Chairman and some/all the teachers of the Department as its members.

**Result and Grievances Redressal Committee:**

The University shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD. This Committee shall solve all grievances relating to the Assessment of the students.

**Grade Awards:**

(i) A ten point rating scale shall be used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master's Program. Grade points are based on the total number of marks obtained by him/her in all the heads of examination of the course. These grade points and their equivalent range of marks are shown separately in Table-I.

**Table I: Ten point grades and grade description**

| Sr. No. | Equivalent Percentage | Grade points | Grade | Grade description |
|---|---|---|---|---|
| 1. | 90.00- 100 | 9.00- 10 | O | Outstanding |
| 2. | 80.00- 89.99 | 8.00- 8.99 | $A^{++}$ | Excellent |
| 3. | 70.00- 79.99 | 7.00- 7.99 | $A^{+}$ | Exceptional |
| 4. | 60.00- 69.99 | 6.00- 6.99 | A | Very good |
| 5. | 55.00- 59.99 | 5.50- 5.99 | $B^{+}$ | Good |
| 6. | 50.00- 54.99 | 5.00- 5.49 | B | Fair |
| 7. | 45.00- 49.99 | 4.50- 4.99 | C+ | Average |
| 8. | 40.01- 44.99 | 4.01- 4.49 | C | Below average |
| 9. | 40 | 4.00 | D | Pass |
| 10. | < 40 | 0.00 | F | Fail |

(ii) Nonappearance in any examination/ assessment shall be treated as the students have secured zero mark in that subject examination/assessment.

(iii) Minimum D grade (4.00 grade points) shall be the limit to clear /pass the course/subject. A student with F grade will be considered as 'failed' in the concerned course and he/she has to clear the course by reappearing in the next successive semester examinations. There will be no revaluation or recounting under this system.

(iv) Every student shall be awarded Grade points out of maximum 10 points in each subject (based on 10 Point Scale). Based on the Grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and cumulative Grade card with CGPA will be given on completion of the course.

## Computation of SGPA (Semester grade point average) &CGPA (Cumulative grade point average)

The computation of SGPA &CGPA, will be as below:

a. **Semester Grade Point Average (SGPA)** is the weighted average of

points obtained by a student in a semester and will be computed as follows:

$$SGPA = \frac{Sum(CourseCredit * Number\ of\ Points\ in\ concern\ gained\ by\ student)}{Sum(CourseCredits)}$$

The Semester Grade Point Average (SGPA) for all the four semesters will be mentioned at the end of every semester.

b. **The Cumulative Grade Point Average (CGPA)** will be used to describe the overall performance of a student in all semesters of the course and will be computed as under:

$$CGPA = \frac{Sum(All\ Four\ Semester\ Credits\ gained\ by\ the\ student)}{Sum(Credits\ of\ All\ Semesters)}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

The SGPA and CGPA shall be rounded off to the second place of decimal.

**Evaluation Method**

Each theory course will be of 100 Marks and be divided in to internal examination (Sessional) of 20 Marks and Semester end examination of 80 Marks. (20+80 = 100 Marks). Each Practical course will be of 50 marks. Research project if any, will be of 100 marks.

a. Internal Evaluation Method
   There shall be two mid semester examinations, first based on 40 percent syllabus taught and second based on 60 percent syllabus taught. The setting of the question papers and the assessment will be done by the concerned teacher who has taught the syllabus. Average score obtained out of two mid semester examinations will be considered for the preparation of final sessional marks/grade.
b. Term end examination and evaluation
   i. Semester end examination time table will be declared by the departmental committee and accordingly the concern course teacher will have to set question paper, conduct theory examination, conduct practical examination with external expert, evaluate, satisfy the objection / query of the student (if any) and submit the result to DC.
   ii. The semester end examination theory question paper will have two parts (20+60 = 80 Marks)
   Part A will carry short question of 2- 3 marks (fill in the blanks/ multiple choice questions/ match columns / state true or false / answer in one sentence) as <u>compulsory questions</u> and it should cover entire syllabus. (20 Marks)
   Part B will carry 7 questions out of which there shall be at least one question from each UNIT, student will have to answer any five questions out of 7

iii. Semester end Practical examinations will be of 50 marks each and students will be examined by one external and one internal examiner. Seminar and Project work (if any) will be evaluated by the external examiners along with guide.

iv. At the end of each semester the Committee of Department shall assign grade points and grades to the students.

v. The Committee of Department shall prepare the copies of the result sheet in duplicate.

vi. Every student shall have the right to scrutinize answer scripts of Mid semester/Term end semester examinations and seek clarifications from the teacher regarding evaluation of the scripts immediately thereafter or within 3 days of receiving the evaluated scripts.

vii. The Head of the department shall display the grade points and grades for the notice of students.

viii. The head of the department shall send all records of evaluation for Safekeeping to the Controller of Examinations as soon as all the formalities are over.

**Grade Card**

The University shall issue at the beginning of each semester a grade card for the student, containing the grades obtained by the student in the previous semester and his Semester Grade Point Average (SGPA).

The grade card shall list:

(a) The title of the courses along with code taken by the student
(b) The credits associated with the course,
(c) The grade and grade points secured by the student,
(d) The total credits earned by the student in that semester.
(e) The SGPA of the student,
(f) The total credits earned by the students till that semester and
(g) The CGPA of the student (At the end of the IV$^{th}$ Semester).

**Cumulative Grade Card**

At the end of the IVth semester, the University shall issue Cumulative Grade Card to the Students showing details of Grades obtained by the student in each subject in all semesters along with CGPA and total credits earned.

## Course Structure

The course is designed with three semesters. The contents of the three semesters are:

### Semester I

| Sr.No | Name of the Course | Scheme of credits |
|---|---|---|
| 1 | Research Methodology | 4 theory+2 tutorial+ 2 seminar = 8 credits |
| 2 | Theory of Computation | 4 theory+2 tutorial+ 2 seminar = 8 credits |

| Course Code | Course Title | No. of Credits | No. of Hours / Week | Total Marks (External) | Total Marks (Internal) |
|---|---|---|---|---|---|
| CSC601 | Research Methodology | 4 | 4 | 80 | 20 |
| CSC651 | Tutorial | 2 | 4 | 50 | - - |
| CSC652 | Seminar | 2 | 4 | 50 | - - |
| CSC602 | Theory of Computation | 4 | 4 | 80 | 20 |
| CSC653 | Tutorial | 2 | 4 | 50 | - - |
| CSC654 | Seminar | 2 | 4 | 50 | - - |

## Semester II

| Sr.No | Name of the Course | Scheme of credits |
|---|---|---|
| 1 | Elective 1 (Select any one from Elective 1) | 4 theory+2 tutorial+2 seminar = 8 credits |
| 2 | Elective 2 (Select any one from Elective 1) | 4 theory+2 tutorial+2 seminar = 8 credits |

### Elective 1: (Select any one from CSC621 to CSC656)

| Course Code | Course Title | No.of Credits | No.of Hours/Week | Total Marks (External) | Total Marks (Internal) |
|---|---|---|---|---|---|
| CSC621 | Advance Image Processing | 4 | 4 | 80 | 20 |
| CSC622 | Data Mining and Data Warehousing | 4 | 4 | 80 | 20 |
| CSC623 | Natural Language Processing | 4 | 4 | 80 | 20 |
| CSC624 | Distributed Systems | 4 | 4 | 80 | 20 |
| CSC625 | Remote Sensing and GIS | 4 | 4 | 80 | 20 |
| CSC655 | Tutorial | 2 | 4 | 50 | - - |
| CSC656 | Seminar | 2 | 4 | 50 | - - |

### Elective 2: (Select any one from CSC626 to CSC630)

| Course Code | Course Title | No. of Credits | No. of Hours/Week | Total Marks (External) | Total Marks (Internal) |
|---|---|---|---|---|---|
| CSC626 | Computer Vision | 4 | 4 | 80 | 20 |
| CSC627 | Speech Processing | 4 | 4 | 80 | 20 |
| CSC628 | Pattern Recognition | 4 | 4 | 80 | 20 |
| CSC629 | Human Computer Interaction | 4 | 4 | 80 | 20 |
| CSC630 | Biometric and Security | 4 | 4 | 80 | 20 |
| CSC657 | Tutorial | 2 | 4 | 50 | - - |
| CSC658 | Seminar | 2 | 4 | 50 | - - |

## Semester III

| Sr.No | Name of Course | Scheme of credits |
|---|---|---|
| 1 | Dissertation Work | 18 credits |

| Course Code | Course Title | No. of Credits | No. of Hours / Week | Total Marks (External) | Total Marks (Internal) |
|---|---|---|---|---|---|
| CSC659 | Dissertation Work | 18 | 36 | 100 | - - |

**Dissertation Work Plan:**

1. Duration: Minimum 06 months and maximum 12 months from start of Semester III.
2. Review: Total three reviews. The schedule and scheme of the review will be given by the guide.
3. Candidate will not be allowed to submit dissertation until he/she clears all the passing heads in there Ist and IInd semester and completes all office formalities and produces a no dues certificate.

**Dissertation Evaluation**

In the beginning of III semester the Department Committee will assign guide to each student. Student has to carry on dissertation work in III semester under the supervision of the guide. The candidate has to submit the dissertation duly signed by the guide to the Department. It will be evaluated by the External Referee recommended by the departmental committee and approved by Vice chancellor. The Final viva- Voce examination will be conducted after the satisfactory report of the panel consists of Guide and the external referee.

# Detailed Syllabus

## Semester-I

During the course if any query appears the final decision will be taken by the departmental

## 1. Research Methodology

| | | | |
|---|---|---|---|
| **Subject Reference no** | **CSC601** | **Subject Title** | **Research Methodology** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** No mandatory prerequisites for this course however the student should be able to identify the problem in respective domain.

**Course Objectives:**

- To provide a deep and systematic understanding of the nature and conduct of CS research
- To enhance existing transferable key skills
- To develop high order transferable key skills
- To equip students with the ability to undertake independent research
- To remind students of the Legal, Social, Ethical and Professional (LSEP) issues applicable to the computer industry
- To achieve these aims the main objective of research is to find out the truth which is hidden and which has not been discovered as yet. Though each research study has its own specific purpose, we may think of research objectives as falling into a number of following broad groupings:
- To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory or formative research studies);
- To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as descriptive research studies);
- To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies);
- To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis testing research studies).

## Section A (Credit: 4)

**Course Outline:**

**Unit 1: Research Methodology:** An Introduction, Defining the Research Problem, Research Design, Sampling Design, Measurement and Scaling Techniques

**Unit 2: Methods of Data Collection:** Processing and Analysis of Data, Sampling Fundamentals, Testing of Hypotheses-I, Chi-square Test, Analysis of Variance and Covariance,

**Unit 3:** Testing of Hypotheses-II, Multivariate Analysis Techniques, Interpretation and Report Writing, The Computer: Its Role in Research

**Unit 4:** The nature of CS research: Literature searches, information gathering, Reading and understanding research papers, Technical writing, referencing, bibliographies, Topics in Computer Science, Presentation skills, written and oral.

**Unit 5:** Choosing or proposing a project, Commercial and economic considerations in CSIT research, CSIT industry and Professional Organization, Review of legal, ethical, social and professional (LSEP) issues including data protection and standards, Quality Research Strategies

**Books Recommended:**

1. C. R. Kothari – Research Methodology Methods and Techniques - WishwaPrakashan Publishers – Second Edition.
2. Dr. Rajammal, P. Devadas – A Handbook on Methodology of Research – Sri Ramakrishna Mission Vidyalaya College of Rural Higher Education.
3. "Research Methodology" R. Panneerselvam, PHI, New Delhi 2005

**References:**


1. Christian W. Dawson: Projects in Computing and Information Systems (A Student's Guide). Addison Wesley, 2005.
2. Justin Zobel: Writing for Computer Science. Springer, 2004.
3. Anany Levitin "Introduction to the Design and Analysis of Algorithms" Pearson Education 2003.
4. Quantitative Data Analysis in Education: A Critical Introduction Using SPSS - By Paul Connolly
5. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, "Introduction to algorithms" Prentice Hall 1990.
6. Intelligent data analysis: an introduction


**Evaluation:**

1. Overall class response: Attendance and Involvement.
2. Class Test: (Objective and Subjective) on each UNIT.
3. End Term Exam.

## Section B (Credit: 2)

**Student should perform five tutorials on each unit.**

**Assignment 1:**
Study the logical and ethical views, aims and objectives of National and International professional organization for perusing research in computer science and IT field (like ACM, IEEE, Springer, IAPR, IETE, CSI, etc.)
**Note:** Student should search these organizations from their corresponding website and prepare the study report.

**Assignment 2:**
Student should have to prepare the review report on a specific domain area of Computer Science and IT on the basis of published research work (Like Pattern recognition, Computer Vision, Image Processing, AI, Speech Processing, Signal Processing, Software Engineering, and Advanced Networking etc.)
**Note:** Student should choose at least one research area with specific domain and prepare a review report and write a review article.

**Assignment 3:**
A student has to present the prepared review article/paper in the Mini Conference which will be organized at the end of the semester in the Department.

## Section C (Credit: 2)

**Seminar Topics:**
Students are supposed to give seminar topics at the start of the Course. There will be two reviews of the seminar topics before submission of the final report and presentations.

**Note: 1.** Seminar topic should be latest and relevance to the field. The Students should note the following:

- Two seminar topics must be submitted to the concerned teacher(s) and gets teacher(s) approval in writing.
- After approval, the students submit in writing the first review of the seminar topics to concern topic. This must be done after one month after approval of the topics.
- The second review of the topics will be presented after three/four weeks of the first reviews.
- At the end, students must submit the final reports of the seminars to the concerned teachers. After submission of the reports the students have to present the seminar before a panel of examiners consists of one internal and one external examiner. In the final examination the report of both reviews will be placed before the panel.
- After the final presentation the grade will be allotted as per the marks obtained in final presentation and reviews by the panel of examiners.

**Course Outcomes:**

After completion of the course, the student should be able to:

- Assess critically the following methods: literature study, case study, structured surveys, interviews, focus groups, participatory approaches, narrative analysis, cost-benefit analysis, scenario methodology and technology foresight.
- Critically assess research methods pertinent to technology innovation research.
- Critically analyse research methodologies identified in existing literature.
- Propose and distinguish appropriate research designs and methodologies to apply to a specific research project.
- Develop a comprehensive research methodology for a research question.
- Apply the understanding of feasibility and practicality of research methodology for a proposed project

## 2. Theory of Computation

| | | | |
|---|---|---|---|
| **Subject Reference no** | **CSC602** | **Subject Title** | **Theory of Computation** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** students should be aware of discrete mathematics, data structures and algorithms.

**Course Objectives:**

- The objective of this course is set to, understand, achieve and interpret the mechanisms of computational theory & its algorithm for the solution of Human computer interaction and related problem domain.
- TOC course is divided in three sections i.e. Theory Tutorial and Seminar. Each section consists of its separate evaluation process.

**Section A (Credit: 4)**

**Course Outline:**

**Unit 1:** Theory of Automata
**Unit 2:** Regular Sets & Regular Grammars
**Unit 3:** Context Free Grammars & Languages
**Unit 4:** Turing Machines
**Unit 5:** Undecidability.
**Unit 6:** Algorithms: Algorithm design and analysis techniques, General Pattern Matching, Application of FFT, Computational Geometry I, II.
**Unit 7:** Algorithms: Robot, Vision & Image Processing algorithms, Computational learning theory, Cryptanalysis, Parallel Computational Algorithm.

**Section B: Tutorial (Credit: 2)**

**Student should perform five tutorials on each unit.**

Tutorial consists of a report on each UNIT of TOC which should contain the review of that concern UNIT along with new findings, problem/s and challenges, interpretation and discussion & conclusion. (At least one problem from each UNIT should implement practically)

- Candidates should submit the tutorial assignments in the short report form on or before the submission date.
- Oral examination will be conducted at the time of submission.

**Evaluation of section B: (Total Marks: 50)**

- Evaluation of the seven Tutorials along with Oral (Tutorial report: 35 marks; Oral marks: 15)
- Final date of Submission

**Section C: Seminar (Credit: 02)**

- Candidates will have to submit the topic name and a page summary of seminar on latest topic of TOC for prior approval. After approval from the course in-charge they have to prepare the seminar report and submit for final confirmation and certification.
- Final date of Seminar report submission:

**Evaluation of section C: (Total Marks: 50)**

- Candidates should deliver the seminar as per the scheduled date before the panel of Examiners. ( Marks: Seminar report : 15, Presentation and defense :35)
- Date and time of Seminar:

**Books:**

1. Introduction to Automate Theory, Languages & Computation by J E Hop Craft & J D Ullman, Narosa Publications
2. Algorithms & Theory of Computation Handbook Edited by Mikhail J. Atallah, CRC Press

**Reference Books:**

1. Introduction to Languages & Theory of Computation by J C Martin, TMH
2. Mathematical Foundations of Computer Science by BECKMAN

**Note:** After completion and evaluation of the entire three sections grade will be allotted as per the marks obtained.

**Course Outcomes:**

After completion of the course, the student should be able to:

- Acquire a full understanding and mentality of Automata Theory as the basis of all computer science languages design.
- Have a clear understanding of the Automata theory concepts such as RE's, DFA's, NFA's, Stack's, Turing machines, and Grammars.
- Be able to design FAs, NFAs, Grammars, languages modelling, small compilers basics - Be able to design sample automata.
- Be able to minimize FA's and Grammars of Context Free Languages.

## Semester-II

## Elective 1

### 1. Advance Inage Processing

| | | | |
|---|---|---|---|
| **Subject Reference no** | **CSC621** | **Subject Title** | **Advanced Image Processing** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** To learn this course basic knowledge of Digital Signal Processing, Mathematics and Statistical Techniques is must.

**Course Objective:**

- At the end of the course, student can be able to write a system to do perception of pictorial data.

**Unit 1: Introduction:** What is image processing? The origins of digital image processing, examples of fields that use Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing system Digital Image Fundamentals: Elements of visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationship between Pixels, Linear and Nonlinear operations, Image Enhancement in the spatial Domain : 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.

**Unit 2: Image Enhancement in the Frequency Domain:** Background, Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering, Implementation, Image Restoration: 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, Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression.

**Unit 3: Wavelets and Multiresolution Processing:** Background, Multiresolution Expansions, Wavelet Transforms in One Dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression, Image

Compression Standards Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms, Extensions to Gray-Scale Images, Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds, The Use of Motion in Segmentation.

**Unit 4: Representation and Description:** Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Relational Descriptors, Object Recognition: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods 3D vision, geometry: 3D vision tasks, Marr's theory, Other vision paradigms: Active and purposive vision, Basics of projective geometry, Points and hyperplanes in projective space, Homography, Estimating hornography from point correspondences, A single perspective camera, Camera model, Projection and back-projection in homogeneous coordinates, Camera calibration from a known scene, Scene reconstruction from multiple views, Triangulation, Projective reconstruction, Matching Constraints, Bundle adjustment, Upgrading the projective reconstruction, self-calibration, Two cameras, stereopsis, Epipolar geometry; fundamental matrix, Relative motion of the camera; essential matrix, Decomposing the fundamental matrix to camera matrices, Estimating the fundamental matrix from point correspondences, Rectified configuration of two cameras, Computing rectification, Three cameras and trifocal tensor, Stereo correspondence algorithms, Active acquisition of range images, 3D information from radiometric measurements, Shape from shading, Photometric stereo.

**Unit 5: Use of 3D vision:** Shape from X, Shape from motion, Shape from texture, Other shape from X techniques, Full 3D objects, 3D objects, models, and related issues, Line labeling, Volumetric representation, direct measurements, Volumetric modeling strategies, Surface modeling strategies, Registering surface patches and their fusion to get a full 3D model, 3D model-based vision, General considerations, Goad's algorithm, Model-based recognition of curved objects from intensity images, Model-based recognition based on range images, 2D view-based representations of a 3D scene, Viewing space, Multi-view representations and aspect graphs, Geons as a 2D view-based structural representation, Visualizing 3D real-world scenes using stored collections of 2D views, 3Dreconstruction from an unorganized set of 2D views—a case study, Motion analysis: Differential motion analysis methods, Optical flow, Optical flow computation, Global and local optical flow estimation, Combined local-global optical flow estimation, Optical flow in motion analysis, Analysis based on correspondence of interest points, Detection of interest points, Correspondence of interest points, Detection of specific motion patterns, Video tracking, Background modeling, Kernel-based tracking, Object path analysis, Motion models to aid tracking , Kalman filters , Particle filters.

**Books:**


1. Rafael Gonzalez, Richard Woods Digital Image Processing:2/e, Pearson Prentice Hall,2004 ISBN-10: 0201180758 | ISBN-13: 9780201180756
2. Image Processing: Analysis and Machine Vision, Milan Sonka, Thomson Learning

**Reference Books:**


1. Machine Vision, Jain R C Kasturi R, McGrawHill
2. Anil Jain Fundamentals of Digital Image Processing:1/e Pearson Prentice Hall
3. Three Dimensional Computer Vision, Y Shirai, Springer Verlag
4. Computer And Robot Vision Vo I and II, Haralick R M And Shapiro L G, Addison Wesley
5. Computational Vision, Wechsler, Academic Press
6. Robot Vision, Horn B K P, Cambridge MIT press
7. Digital Image Processing & Computer Vision, Robert J Schalkoff, John Willey Publication.
8. Computer Vision: A Modern Approach, Forsyth Ponce , Pearson Education.


**Course Outcomes:**

**After completing this course students will be able to:**

- Analyze general terminology of digital image processing.
- Examine various types of images, intensity transformations and spatial filtering.
- Develop Fourier transform for image processing in frequency domain.
- Evaluate the methodologies for image segmentation, restoration etc.
- Implement image process and analysis algorithms.
- Apply image processing algorithms in practical applications.

## 2. Data Warehousing and Data Mining

| | | | |
|---|---|---|---|
| **Subject Reference no** | **CSC622** | **Subject Title** | **Data Warehousing and Data mining** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** Student must be aware of Relational Database Management System, its organization and management using Queries. Student should have knowledge about the Relational Database Management System and basic knowledge of probability and statistics

**Course Objectives:**

A student completing this course UNIT should:

- Have an understanding of the foundations, the design, the maintenance, the evolution and the use of data warehouses, by looking at these topics in a rigorous way.
- Have mastered the basic range of techniques for creating, controlling and navigating dimensional business databases, by being able to use a powerful tool for dimensional modeling and analysis.
- To develop an understanding of the strengths and limitations of popular data mining techniques and to be able to identify promising business applications of data mining. Students will be able to actively manage and participate in data mining projects executed by consultants or specialists in data mining. A useful take away from the course will be the ability to perform powerful data analysis.

**Unit 1: Data Warehousing Concepts:** Data Warehouse Architectures, **Logical Design in Data Warehouses:** Logical Versus Physical Design in Data Warehouses, Data Warehousing Schemas, Data Warehousing Objects, **Physical Design in Data Warehouses:** Physical Design, Data Segment Compression, Integrity Constraints, Indexes and Partitioned Indexes, Materialized Views, Dimensions, **Indexes:** Bitmap Indexes, Benefits for Data Warehousing Applications, Cardinality, Bitmap Join Indexes, Bitmap Join Index Restrictions, B-tree Indexes, Local Indexes Versus Global Indexes, **Integrity Constraints:** Overview of Constraint States, Typical Data Warehouse Integrity Constraints, UNIQUE Constraints in a Data Warehouse, FOREIGN KEY Constraints in a Data. Warehouse, RELY Constraints, Integrity Constraints and Parallelism, Integrity Constraints and Partitioning

**Unit 2: Dimensions:** Creating Dimensions, Viewing Dimensions, Using Dimensions with Constraints, Validating Dimensions, Altering Dimensions, Deleting Dimensions, Using the Dimension Wizard, **Overview of Extraction, Transformation, and Loading:** Overview of ETL, ETL Tools, **Managing the Warehouse Environment:** Overview of Extraction, Transformation and Loading, Extraction in Data Warehouses Transportation in Data Warehouses, Loading and Transformation, Maintaining the Data Warehouse, Change Data Capture, Summary Advisor, **Loading and Transformation:** Overview of Loading and Transformation in Data Warehouses, Loading Mechanisms, Transformation Mechanisms, Loading and Transformation Scenarios, **Maintaining the Data Warehouse:** Using Partitioning to Improve Data Warehouse Refresh, Optimizing DML Operations During Refresh, Refreshing Materialized Views, Using Materialized

Views with Partitioned Tables

**Unit 3: Data Mining: Data:** What is Data? Attribute Values, Measurement of Length, Types and Properties of Attributes, Discrete and Continuous Attributes, Types of data sets, Data Quality, Data Preprocessing, Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation, Discretization and Binarization, Attribute Transformation, Density. **Data Mining: Exploring Data:** Data Exploration Techniques, Summary Statistics, Frequency and Mode, Percentiles, Measures of Location: Mean and Median, Measures of Spread: Range and Variance, Visualization, Representation, Arrangement, Selection, Visualization Techniques: Histograms, Box Plots, Scatter Plots, Contour Plots, Matrix Plots, Parallel Coordinates, Other Visualization Techniques, OLAP : OLAP Operations

**Unit 4: Data Mining Classification: Bask Concepts, Decision Trees, and Model Evaluation** Classification: Definition, Classification Techniques, Tree Induction, Measures of Node Impurity, Practical Issues of Classification, ROC curve, Confidence Interval for Accuracy, Comparing Performance of Two Models, and Comparing Performance of Two Algorithms. **Data Mining Association Analysis:** Basic Concepts and Algorithms Association Rule Mining, Frequent Itemset Generation, Association Rule Discovery: Hash tree, Factors Affecting Complexity, Maximal Frequent Horible Closed Itemset, Alternative Methods for Frequent Itemset Generation, FP-growth Algorithm, Tree Projection, Rule Generation, Pattern Evaluation, Statistical Independence, Properties of A Good Measure, Support-based Pruning, Subjective Interestingness Measure.

**Unit 5: Data Mining Cluster Analysis: Basic Concepts and Algorithms:** Applications of Cluster Analysis, Types of Clusters, Clustering Algorithms: K-means and its variants, Hierarchical clustering, Density-based clustering. Graph-Based Clustering, Limitations of Current Merging Schemes, Characteristics of Spatial Data Sets, Shared Near Neighbor Approach, ROCK (RObust Clustering using linKs), Jarvis-Patrick Clustering, SNN Clustering Algorithm. Data Mining Anomaly Detection Anomaly/Outlier Detection, Importance, Anomaly Detection Schemes, Density-based: LOF approach.

**Books:**


1. Kimball, Reeves Ross, Thornthwaite, The Data Warehouse Lifecycle Toolkit, John Wiley & Sons, 1998.
2. Arun K Pujari, Data Mining Techniques, University Press, Tenth edition 2006, ISBN 81 7371 380 4

**Reference Books:**


1. Oracle9i Data Warehousing Guide Release 2 (9.2) Part Number A96520-01 by Oracle Press.
2. Introduction to Data Mining by Tan, Steinbach, Kumar.
3. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers.
4. Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten and Eibe Frank, Morgan Kaufmann, 2nd Edition (2005).
5. Principles of Data Mining: David Hand, Heikki Mannila & Padhraic Smyth, PHP Publication.


**Course Outcomes:**

**After completing this course students will be able to:**

- Store voluminous data for online processing
- Preprocess the data for mining applications
- Apply the association rules for mining the data
- Design and deploy appropriate classification techniques
- Cluster the high dimensional data for better organization of the data
- Discover the knowledge imbibed in the high dimensional system
- Evolve Multidimensional Intelligent model from typical system

## 3. Natural Language Processing

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|---|---|---|---|
| **Subject Reference no** | **CSC623** | **Subject Title** | **Natural Language Processing** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** The student should have the basic knowledge of artificial intelligence and a clear understanding of English grammar.

**Course Objective:**

- To learn the concept to make the system automated to understand natural language.

**Course Outline:**

**Unit 1: NLP:** Introduction to NLP, Brief History & Achievements, Some Applications, Open problems, Major Goals.

**Unit 2: Language Structure & Language Analyzer:** Introduction to Language Structure, Overview of Language Analyzer, Morphological Analysis, Local word Grouper (LWG), Core Parser, Requirements of Computational Grammar, Computational Aspect, System Aspect, Large Systems Aspect

**Unit 3: Words and their Analyzer:** Introduction, Why Morphological Analysis, Morphological Generation Using paradigms, Morphological Analysis Using paradigms

**Unit 4: Local word Grouper (LWG) and Pannian Grammar:** Introduction, Verb and Noun groups, Strategy for grammar development, Semantics in stages, semantic model, core parser.

**Unit 5: Machine Translation and Comparison with some western computational grammars:** Introduction, brief history, Language Accessor etc, Lexical functional grammar, Introduction, Computational Aspects etc.

**Books:**

1. Natural Language Processing A Paninian Perspective-Akshar Bharati, Vineet Chaitanya, Rajeev Sangal.
2. Natural Language Processing with Python, Analyzing Text with the natural Language Toolkit, Steven Bird, Ewan Klein and Edward Loper, O'Reilly Media,2009

**Reference Books:**

1. Natural Language Processing and knowledge Representation Language for Knowledge and Knowledge for Language Edited by Lucja M. Iwanska and Stuart C. Shapiro
2. Natural Language processing with Python, Analyzing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, Edward Loper.

**Course Outcomes:**

**Students successfully completing the module should understand:**

- Relevant linguistic concepts
- Relevant ML techniques, in particular structured prediction
- What makes NLP challenging (and exciting)
- How to write programs that process language

How to rigorously formulate NLP tasks as learning and inference tasks, and address the computational challenges involved.

## 4. Distributed Systems

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|---|---|---|---|
| **Subject Reference no** | **CSC624** | **Subject Title** | **Distributed Systems** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** the student should have taken an undergraduate course in operating systems and understand basic operating system concepts such as processes, threads, file system implementation, mutual exclusion, process synchronization, and process scheduling and can program proficiently in the C or C++ programming language as well as Java.

**Course Objectives:**
The goal for students in this course is to learn the fundamentals of Distributed Systems including:

- Overview of distributed systems
- Communication
- Naming
- Synchronization
- Consistency and replication
- Fault tolerance
- Security

Where possible and appropriate, we will use examples from modern distributed systems such as peer-to-peer systems, distributed gaming, and distributed file systems to illustrate concepts discussed in class.

**Course Outline:**
**Unit 1:** Characterization of Distributed Systems, Design Issues, User Requirement, Network Technologies and Protocols, IPC, Client-Server Communication, Group Communication, IPC in UNIX - Remote Procedure Calling, Design issues, Implementation, Asynchronous RPC

**Unit 2:** Distributed OS, Its kernel, Processes and Threads, Naming and Protection, Communication and Invocation, Virtual Memory, File Service components, Design issues, Interfaces, implementation techniques, SUN network file systems

**Unit 3:** SNS – a name service model, its design issues, Synchronizing physical clocks, Logical time and logical clocks, Distributed coordination. Replication and its architectural model, Consistency and request ordering, Conversation between a client and a server, Transactions, Nested Transactions- Concurrency control, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency control.

**Unit 4:** Distributed Transactions and Nested Transactions, Atomic commit protocols, Concurrency control in distributed transactions, distributed Deadlocks, Transactions with replicated data, Transaction recovery, Fault tolerance, Hierarchical and group masking of faults - **Cryptography**, Authentication and key distribution, Logics of Authentication, Digital signatures.

**Unit 5:** Distributed shared memory, Design and Implementation issues, Sequential consistency and ivy, Release consistency and Munin, Overview of Distributed Operating systems Mach, Chorus.

**Books:**

1. Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Third Edition, Pearson Education.

**Reference Books:**

1. Advanced Concepts in Operating Systems, M Singhal, N G Shivarathri, Tata McGraw-Hill Edition.
2. Distributed Systems – Principles and Paradigms, A.S. Tanenbaum and M. V. Steen, Pearson Education.

**Course Outcomes:**

**Students successfully completing the module should understand:**

- Identify the advantages and challenges in designing distributed algorithms for different
- Primitives like mutual exclusion, deadlock detection, agreement, etc.
- Design and develop distributed programs using sockets and RPC/RMI.
- Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems.
- Analyze different algorithms and techniques for the design and development of distributed systems subject to specific design and performance constraints.

## 5. Remote Sensing and GIS

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|---|---|---|---|
| **Subject Reference no** | **CSC625** | **Subject Title** | **Remote Sensing and GIS** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** To learn this course basic knowledge of Digital Image processing, Digital Signal Processing, Matrix manipulations, Mathematics and Statistical Techniques is must.

**Course Objectives:**

- Introduction to Geographic Information Systems is a course designed to provide students in a solid foundation in both GIS concepts and the use of GIS.
- Introduction to GIS strikes a careful balance between GIS concepts and hands-on applications.
- The main portion of the course presents GIS terms and concepts and helps students learn how each one fits into a complete GIS system.
- At the end of the course students can work with actual GIS exercises and the necessary data to solve the problem.

**Course Outline:**

**Unit 1:** Introduction Coordinate Systems Vector Data Model Raster Data Model

**Unit 2:** GIS Data Acquisition, Geometric Transformation, Spatial Data Editing Attribute Data Management

**Unit 3:** Data Display and Cartography, Data Exploration, Vector Data Analysis, Raster Data Analysis

**Unit 4:** Terrain Mapping and Analysis,Viewsheds and Watershed ,Spatial Interpolation

**Unit 5:** Geocoding and Dynamic Segmentation Path Analysis and Network Applications GIS Models and Modeling

**Text Books:**

1. Introduction to Geographic Information Systems with Data Files CD-ROM, Kang-tsung Chang, 2010, Tata McGraw-Hill, ISBN: 9780077294366

**Lab Exercise:**
At Least two experiments should do on each UNIT

**Course Outcomes:**
**Students successfully completing the module should understand:**
Follow and learn about principles, tools, and applications of remote sensing and GIS and recent advances in these fields

- Summarize in written form, the contents of technical papers and oral presentations
- Critique technical presentations for contents and presentation styles.
- Realize and appreciate the multidisciplinary nature of the fields of remote sensing and GIS.

# Elective 2

## 1. Computer Vision

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|---|---|---|---|
| **Subject Reference no** | **CSC626** | **Subject Title** | **Computer Vision** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** Problem Solving and Object Oriented Technologies.

**Course Objective:**

- To provide the mechanics for representation and analysis of Multispectral data.

**Unit 1: CAMERAS:** Pinhole Cameras, Perspective Projection, Affine Projection, **RADIOMETRY- MEASURING LIGHT:** Light in, Foreshortening, Solid Angle, Radiance, Light at Surfaces, Simplifying Assumptions, The Bidirectional Reflectance Distribution Function, Example: The Radiometry of Thin Lenses, Important Special Cases, Radiosity, Directional Hemispheric Reflectance, Lambertian Surfaces and Albedo, Specular Surfaces, The Lambertian + Specular **Model. SOURCES, SHADOWS, AND SHADING:** Qualitative Radiometry, Sources and Their Effects, Radiometric, Properties of Light Sources, Point Sources, Line Sources, Area Sources, Local Shading Models, Local Shading Models for Point Sources, Area Sources and Their Shadows, Ambient Illumination, Application: Photometric Stereo, Normal and Albedo from Many Views, Shape from Normals, Interreftections: Global Shading Models, An Interreflection Model, Solving for Radiosity, The Qualitative Effects of Interreftections, **COLOR:** The Physics of Color, Radiometry for Colored Lights: Spectral Quantities, The Color of Sources, The Color of Surfaces, Human Color Perception, Color Matching, Color Receptors, Representing Color, Linear Color Spaces, Non-linear Color Spaces, Spatial and Temporal Effects, A Model for Image Color, Cameras, A Model for Image Color, Application: Finding Specularities, Surface Color from Image Color, Surface Color Perception in People, Inferring Lightness, Surface Color from Finite-Dimensional Linear Models

**Unit 2: LINEAR FILTERS:** Linear Filters and, Convolution, Shift Invariant Linear Systems, Discrete Convolution, Continuous Convolution. , Edge Effects in Discrete Convolutions, Spatial Frequency and Fourier Transforms , Fourier Transforms, Sampling and Aliasing, Sampling, Aliasing, Smoothing and Resampling, Filters as Templates, Convolution as a Dot Product, Changing Basis, Technique: Normalized Correlation and Finding Patterns , Controlling the Television by Finding Hands by Normalized Correlation, Technique: Scale and Image Pyramids , The Gaussian Pyramid, Applications of Scaled Representations, **EDGE DETECTION:** Noise, Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives, Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian?, Detecting Edges, Using the Laplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners, **TEXTURE:** Representing Texture, Extracting Image Structure with Filter Banks, Representing Texture Using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids ,The Laplacian

Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids, Application: Synthesizing Textures for Rendering , Homogeneity, Synthesis by Sampling Local Models,

**Unit 3: THE GEOMETRY OF MULTIPLE VIEWS:** Two Views, Epipolar Geometry, The Calibrated Case, Small Motions, The Uncalibrated Case, Weak Calibration, Three Views , Trifocal Geometry, The Calibrated Case, The Uncalibrated Case, Estimation of the Trifocal Tensor, **STEREOPSIS:** Reconstruction, Image Rectification, Human Stereopsis, Binocular Fusion, Correlation, Multi-Scale Edge Matching, Using More Cameras Three Cameras, Multiple Cameras, **SEGMENTATION BY CLUSTERING**: What Is Segmentation? Model Problems, Segmentation as Clustering, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Background Subtraction, Shot Boundary Detection, Image Segmentation by Clustering Pixels, Segmentation Using Simple Clustering Methods, Clustering and Segmentation by K-means, Segmentation by Graph-Theoretic Clustering, Terminology for Graphs, The Overall Approach, Affinity Measures, Eigenvectors and Segmentation, Normalized Cuts,

**Unit 4: SEGMENTATION BY FITTING A MODEL:** The Hough Transform, Fitting Lines with the Hough Transform, Practical Problems with the Hough Transform, Fitting Lines, Line Fitting with Least Squares, Which Point Is on Which Line?, Fitting Curves, Implicit Curves, Parametric Curves, Fitting as a Probabilistic Inference Problem, Robustness, M-estimators, RANSAC, Example: Using RANSAC to Fit Fundamental Matrices, An Expression for Fitting Error, Correspondence as Noise, Applying RANSAC, Finding the Distance, Fitting a Fundamental Matrix to Known Correspondences, **SEGMENTATION AND FITTING USING PROBABILISTIC METHODS:** Missing Data Problems, Fitting, and Segmentation, Missing Data Problems, The EM Algorithm, The EM Algorithm in the General Case, The EM Algorithm in Practice, Example: Image Segmentation, Revisited, Example: Line Fitting with EM, Example: Motion Segmentation and EM, Example: Using EM to Identify Outliers, Example: Background Subtraction Using EM, Example: EM and the Fundamental Matrix, Difficulties with the EM Algorithm, Model Selection: Which Model Is the Best Fit? Basic Ideas, AIC-An Information Criterion, Bayesian Methods and Schwartz' BIC, Description Length, Other Methods for Estimating Deviance, **MODEL-BASED VISION:** Initial Assumptions, Obtaining Hypotheses, Obtaining Hypotheses by Pose Consistency , Pose Consistency for Perspective Cameras, Affine and Projective Camera Models, Linear Combinations of Models, Obtaining Hypotheses by Pose Clustering, Obtaining Hypotheses Using Invariants , Invariants for Plane Figures, Geometric Hashing, Invariants and Indexing, Verification, Edge Proximity, Similarity in Texture, Pattern and Intensity, Application: Registration in Medical Imaging Systems, Imaging Modes, Applications of Registration, Geometric Hashing Techniques in Medical Imaging, Curved Surfaces and Alignment.

**Unit 5: FINDING TEMPLATES USING CLASSIFIERS:** Classifiers, Using Loss to Determine Decisions, Overview: Methods for Building Classifiers, Example: A Plug-in Classifier for Normal Class- conditional Densities, Example: A Nonparametric Classifier Using Nearest Neighbors, Estimating and Improving Performance, Building Classifiers from Class Histograms, Finding Skin Pixels Using a Classifier, Face Finding Assuming Independent Template Responses, Feature Selection, Principal Component Analysis, Identifying Individuals with Principal Components Analysis, Canonical Variates, Neural Networks, Key Ideas, Minimizing the Error, When to Stop

Training, Finding Faces Using Neural Networks, Convolutional Neural Nets, Support Vector Machines for Linearly Separable Daiasets, Finding Pedestrians Using Support Vector Machines **RECOGNITION BY RELATIONS BETWEEN TEMPLATES:** Finding Objects by Voting on Relations between Templates, Describing Image Patches, Voting and a Simple Generative Model, Probabilistic Models for Voting, Voting on Relations, Voting and 3D Objects, Relational Reasoning Using Probabilistic Models and Search, Correspondence and Search, Example: Finding Faces, Using Classifiers to Prune Search, Identifying Acceptable Assemblies Using Projected Classifiers, Example: Finding People and Horses Using Spatial Relations, Technique: Hidden Markov Models, Formal Matters, Computing with Hidden Markov Models, Varieties of HMMs, Application: Hidden Markov Models and Sign Language Understanding, Language Models: Sentences from Words, Application: Finding People with Hidden Markov Models **GEOMETRIC TEMPLATES FROM SPATIAL RELATIONS:** Simple Relations between Object and Image, Relations for Curved Surfaces, Class-Based Grouping, Primitives, Templates, and Geometric Inference Generalized Cylinders as Volumetric Primitives, Ribbons, What Can One Represent with Ribbons? Linking 3D and 2D for Cylinders of Known Length, Linking 3D and Image Data Using Explicit Geometric Reasoning, Afterword: Object Recognition, the Facts on the Ground, Current Approaches to Object Recognition, Limitations.

**Books:**

1. Computer Vision: A Modern Approach, Forsyth Ponce, Pearson Education
2. Image Processing, Analysis and Machine Vision, Milan Sonka, Thomson Learning

**Reference Books:**

1. Machine Vision, Jain R C Kasturi R, McGrawHill
2. Three Dimensional Computer Vision, Y Shirai, Springer Verlag
3. Computer And Robot Vision Vo I and II, Haralick R M And Shapiro L G, Addison Wesley
4. Computational Vision, Wechsler, Academic Press
5. Robot Vision, Horn B K P, Cambridge MIT press
6. Digital Image Processing & Computer Vision, Robert J. Schalkoff, John Willey Publication

**Course Outcomes:**

**After completing this course students will be able to:**

- Implement fundamental image processing techniques required for computer vision
- Perform shape analysis
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Implement motion related techniques.
- Develop applications using computer vision techniques.

## 2. Speech Processing

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|---|---|---|---|
| **Subject Reference no** | **CSC627** | **Subject Title** | **Speech Processing** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** It is designed to be self-contained. However, a course on Signals and Systems and Digital Signal Processing will come in handy for appreciating the course.

**Course Objectives:**

The course covers the main aspects of speech processing by computer. Topics include:

- models of the vocal tract;
- identification and extraction of speech features;
- speech compression; the recognition of speech and speakers by computer;
- control of speech synthesizers.

In the required projects, students will implement speech analysis software and build a small speech recognition or compression system.

**Course Outline:**

**Unit 1:** Speech production and representation: articulation, hearing, classification of phonetic UNITs, digital representations of speech, short-time Fourier analysis

**Unit 2:** Speech analysis: linear pred ictive coding, cepstrum analysis, distortion measures, vector quantization, pitch determination and excitation identification

**Unit 3:** Speech compression/coding: code-excited linear prediction (CELP) MPEG coding wavelet-based coding

**Unit 4:** Automatic recognition of speech: dynamic time warping, hidden Markov models

**Unit 5:** Speech synthesis: speech synthesizers, text-to-speech systems.

**Books:**

1. L. Rabiner and B.-H. Juang, Fundamentals of Speech Recognition, Prentice Hall, 1995, ISBN 0- 13-015157-2

**Additional References:**


1. L. R. Rabiner and R. W. Schafer, Digital Processing of Speech Signals, Prentice-Hall, 1978, ISBN 0-13-213603-1.
2. J. L. Flanagan, Speech Analysis Synthesis and Perception, second edition, Springer-Verlag (1972).


**Course Outcomes:**

**Students successfully completing the module should understand:**

- Express the speech signal in terms of its time domain and frequency domain representations and the different ways in which it can be modelled;
- Derive expressions for simple features used in speech classification applications;
- Explain the operation of example algorithms covered in lectures, and discuss the effects of varying parameter values within these;
- Synthesize block diagrams for speech applications, explain the purpose of the various blocks, and describe in detail algorithms that could be used to implement them;
- Implement components of speech processing systems, including speech recognition and speaker recognition, in MATLAB.
- Deduce the behavior of previously unseen speech processing systems and hypothesize about their merits.

## 3. Pattern Recognition

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|---|---|---|---|
| **Subject Reference no** | **CSC628** | **Subject Title** | **Pattern Recognition** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** Fundamentals of probability and linear algebra

**Course Objective:** To provide the general mechanism and design of Automatic system recognition.

**Course Outline:**

**Unit 1: Introduction to Pattern Recognition, Bayesian decision theory:** Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, discrete features

**Unit 2: Maximum Likelihood and Bayesian Estimation:** Parameter estimation methods, Maximum- Likelihood estimation, Bayesian estimation, Bayesian Parameter Estimation, Gaussian Case, General Theory, Problem of Dimensionality, Accuracy, Dimension, and Training Sample Size, Computational Complexity and Overfitting, Component Analysis and Discriminants, Principal Component Analysis (PCA), Expectation Maximization (EM), Hidden Markov models for sequential pattern classification, First-Order Markov Models, First-Order Hidden Markov Models, Hidden Markov Model Computation, Evaluation, Decoding and Learning.

**Unit 3: Non-parametric :** Density estimation, Parzen-window method, Probabilistic Neural Networks (PNNs), K-Nearest Neighbour , Estimation and rules, Nearest Neighbour and Fuzzy Classification. **Linear Discriminant function based classifiers:** Perceptron, Linear Programming Algorithm, Support Vector Machines (SVM)

**Unit 4: Multilayer Neural Network:** Feed Forward Classification, Back Propagation Algorithm, Error Surface **Stochastic Data:** Stochastic search, Boltzmann Learning, Evolutionary method and Genetic Programming.

**Unit 5: Non-metric methods for pattern classification:** Decision trees, Classification and Regression Trees (CART) and other tree methods, String recognition and Rule Based method. **Unsupervised learning and clustering :** Mixture Densities and Identifiability, Maximum Likelihood estimation, Application Normal Mixture, Unsupervised Bayesian Learning, Data Description and Clustering, Hierarchical Clustering, Graph theory method, Problem of validity, Component analysis

**Books:**


1. R.O.Duda, P.E.Hart and D.G.Stork, “Pattern Classification 2nd Edition”, John Wiley, 2007
2. Christopher M. Bishop, “Neural Network for Pattern Recognition”, Oxford Ohio Press.

**Reference Books:**


1. E. Gose, R. Johansonbargh, "Pattern Recognition and Image Analysis", PHI
2. Ethen Alpaydin, "Introduction to Machine Learning", PHI
3. Satish Kumar,"Neural Network- A Classroom Approach", McGraw Hill.
4. Dr. Rao & Rao,Neural Network & Fuzzy Logic
5. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press,
6. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2006


**Web:**

1. http://www.rii.ricoh.com/~stork/DHS.html

**Course Outcomes:**

- Design systems and algorithms for pattern recognition (signal classification), with focus on sequences of patterns that are analyzed using, e.g., hidden Markov models (HMM),
- Analyse classification problems probabilistically and estimate classifier performance,
- Understand and analyse methods for automatic training of classification systems,
- Apply Maximum-likelihood parameter estimation in relatively complex probabilistic models, such as mixture density models and hidden Markov models.
- Understand the principles of Bayesian parameter estimation and apply them in relatively simple probabilistic models

## 4. Human Computer Interaction

| | | | |
|---|---|---|---|
| **Subject Reference no** | **CSC629** | **Subject Title** | **Human Computer Interaction** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** CS, IS, Engineering Majors: Demonstrable programming skill in at least one high level language

**Course Objectives:**

- Design, implement and evaluate effective and usable graphical computer interfaces.
- Describe and apply core theories, models and methodologies from the field of HCI.
- Describe and discuss current research in the field of HCI.
- Implement simple graphical user interfaces using the Java Swing toolkit.
- Describe special considerations in designing user interfaces for older adults

**Course Outline:**

**Unit 1: Foundations:** The human, The computer, The interaction, Paradigms

**Unit 2: Design Process-I:** Interaction design basics, HCI in the software process, Design rules

**Unit 3: Design Process-II:** Implementation support, Evaluation techniques, Universal design, User support

**Unit 4: Models and Theories:** Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Dialogue notations and design, Models of the system, Modelling rich interaction.

**Unit 5: Outside the Box:** Groupware, Ubiquitous computing and augmented realities, Hypertext, multimedia, and the World Wide Web.

**Books:**


1. Human Computer Interaction 3e - Dix, Finlay, Abowd, Beale.
2. Readings in Human Computer Interaction: Towards the Year 2000: 2nd Edition; Ronald Baecker, Jonathan Grudin, William Buxton, Saul Greenberg.
3. William M. Newman and Michael G. Lamming, Interactive System Design, Addison-Wesley (1995) (0-201-63162-8).
4. Jakob Nielsen, Designing Web Usability: The Practice of Simplicity, New Riders, 1st Ed(Dec 1999) (1-562-05810-X).
5. Jenny Preece - Yvoone Rogers, Helen Sharp, David Benyon, Simon Holland and Tom Carey, Human-Computer Interaction, Addison-Wesley (1994) (0-201-62769-8).

**Course Outcomes:**

On completion of this course according to course goals, the student should be able to:

- Understand the basics of human and computational abilities and limitations.
- Understand basic theories, tools and techniques in HCI.
- Understand the fundamental aspects of designing and evaluating interfaces.
- Practice a variety of simple methods for evaluating the quality of a user interface.

Apply appropriate HCI techniques to design systems that are usable by people.

## 5. Biometrics and Security Systems

| | | | |
|---|---|---|---|
| **Subject Reference no** | **CSC630** | **Subject Title** | **Biometrics and Security Systems** |
| **No of Credits** | **4 Theory, 2Seminar, 2Tutorial** | **Assignment/ Sectionals (Internal)** | **20%** |
| **Total Contact Hrs./Week** | **4 Theory, 8 Practical** | **(Semester Exam)** | **80%** |

**Prerequisite:** UG level concepts of Number Theory

**Course Objectives:** To learn:

1. Details multimodal biometrics and its exceptional utility for increasingly reliable human recognition systems.
2. Reveals the substantial advantages of multimodal systems over conventional identification methods.

**Course Outline:**

**Unit I:** Biometrics: When Identity Matters

**Unit 2:** Information Fusion in Biometrics

**Unit 3:** Levels of Fusion in Biometrics.

**Unit 4:** Score Level Fusion

**Unit 5:** Fusion Incorporating Ancillary Information.

**Reference Book:**

1. Handbook of Multibiometrics, Ross, Arun A., Nandakumar, Karthik, Jain, Anil K, 2006, Springer, ISBN 978-0-387-22296-7

**Lab Exercise**

At least two experiments should do on each UNIT

**Course Outcomes:**

**Students successfully completing the module should understand:**

- Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
- Understand and analyze biometric systems at the component level and be able to analyze and design basic biometric system applications.
- Be able to work effectively in teams and express their work and ideas orally and in writing. Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
- Understand various Biometric security issue.

IQAC Cell

# DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

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