Dr. Babasaheb Ambedkar Marathwada Univeristy

Aurangabad

Department of Computer Science & Information Technology

Reaccredited with 'A' Grade

Curriculum Book

M.Phil Computer Science

2018-2019

Outcome Based Education Curriculum

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, 2018-19

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

Choice Based Credit System and OBE
M.Phil. Computer Science
(2018-2019)

SCHEME FOR CHOICE BASED CREDIT SYSTEM (CBCS)
w.e.f. JUNE, 2018 (ACADEMIC YEAR, 2018-19 Onwards)

Index

M.Phil. (Computer Science) 2018-19

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:

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:

Duration: The Duration of the course is 18 months.

Intake Capacity: Intake Capacity: 20

a) Common Entrance Test

Those students who are seeking admission to M. Phil. in Computer Science in the Department have to go through the centralized CET Examination. Student who qualified UGC-NET (Including JRF), UGC-CSIR NET (Including JRF) / SLET/GATE/Teacher Fellowship are exempted from entrance test (O.187)

b)CET Exam Pattern

As per the guidelines of the University.

c) 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.

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

Conduction of M.PHIL COURSE WORK

After having been admitted, each M. Phil Student shall be required to undertake 30 credits course work for a minimum period of one / two semester. The course work shall be treated as per M. Phil preparation and must include a course on research methodology which may include quantitative methods and computer applications. It may also involve reviewing of published research in the relevant field. All Provisionally registered candidates should complete the M. Phil Course work of ten credits within one year.

The overall minimum credit requirement including credit for M. Phil course work being 30 credits. 08 Credits for research methodology and remaining 22 credits for theory and dissertation.(O.187)

i. The **course work** shall be based on research components (1 Credits = 15 clock hours) :
   I) Research Methodology (includes –
      a) Quantitative Methods: 2 Credit
      b) Computer Application: 2 Credit
      c) Review of Literature relevant field, Research Ethics: 2 Credit
      d) Training and field work: 1 Credit
      e) Seminar (Minimum 4): 1 Credit

   Total: 08 Credits

ii. The distribution of credits for the theory and dissertation are as follows
   1. Theory component – 3 of 5 credits 15 Credits
   2. Dissertation 07 Credits
   Total 22 Credits

   Total credits for the course = 08+22 = 30 credits

iii. Each Course shall include lectures / tutorials / laboratory or field work / Seminar / Practical training / Assignments / midterm and term end examinations/ paper / Report writing or review of literature and any other innovative practice etc., to meet effective teaching and learning needs.
iv. Attendance: - Students must have 75% of attendance in each Core and Elective course for appearing the examination.

Grade in the course work including research methodology shall be finalized after a combined assessment by the departmental committee / research advisory committee of the respective department. The final grade shall be communicated to the P.G. Section by the Chairman departmental committee. M. Phil Scholar has to obtain a minimum of 55% of marks or its equivalent grade or CGPA in the course work in order to be eligible to continue in the programme and submit the dissertation

Departmental Committee:

Every ACADEMIC program of the University 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 and its members.

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 2011-12.

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.

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

Results 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.

ii.) Non appearance 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.

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Departmental Committee:-

Every ACADEMIC program of the University 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 and its members.

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. (80+20 = 100 Marks). Similarly Each tutorial, seminars, field work, training as defined in course will be of 50 marks (40+10=50 Marks). Research Dissertation if any, will be of 100 (80+20=100) marks.

a. Internal Evaluation Method

The internal evaluation for the course where internal assessment is defined in case of theory subjects will be governed through two class tests as per predefined schedule. The best performance out of the two internal class test will be considered for final award of grades.

In case of internal evaluation for tutorial/seminars/field visits the internal assessment will based on review submitted, assignment submitted, involvement of student and report submitted by the students. Internal Evaluation for Minimum two seminar (Review I and Review II) on the decided topic which will be presented in the final Exam.

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 Departmental Committee.

ii. The semester end examination theory question paper will have two parts (20+60 = 80 Marks)

Part A will carry short question of 1 or 2 marks (fill in the blanks/ multiple choice questions/ match columns / state true or false / answer in one sentence) as compulsory questions 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 inclusive of one problem oriented question.

iii. Semester end TUTORIAL AND SEMINAR examinations will be of 40 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 IIIrd Semester).

Cumulative Grade Card

At the end, 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	6 theory+1 Training and Field work + 1 seminar = 8 credits
2	Pattern Recognition	3 theory+1 Tutorial+ 1 seminar = 5 credits

Course Code	Course Title	No. of Credits	No. of Hours / Week	Total Marks (External)	Total Marks (Internal)
CSC601	Research Methodology	6	6	80	20
CSC651	Training and Field work	1	2	40	10
CSC652	Seminar	1	2	40	10
CSC602	Pattern Recognition	3	3	80	20
CSC653	Tutorial	1	2	40	10
CSC654	Seminar	1	2	40	10

Semester II:

Sr. No	Name of the Course	Scheme of credits
1	Elective 1 (Select any one from Elective 1)	3 theory+1 Tutorial+1 seminar = 5 credits
2	Elective 2 (Select any one from Elective 2)	3 theory+1 Tutorial+1 seminar = 5 credits

Course Code	Course Title	No. of Credits	No. of Hours / Week	Total Marks (External)	Total Marks (Internal)
CSC621	Elective 1 (Select any one from Elective 1)	3	3	80	20
CSC655	Tutorial	1	2	40	10
CSC656	Seminar	1	2	40	10
CSC631	Elective 2 (Select any one from Elective2)	3	3	80	20
CSC657	Tutorial	1	2	40	10
CSC658	Seminar	1	2	40	10

Elective 1: (Select any one from CSC621 to CSC625)

Course Code	Course Title
CSC621	Advance Image Processing
CSC622	Data Mining and Data Warehousing
CSC623	Natural Language Processing
CSC624	Digital Signal Processing
CSC625	Remote Sensing and GIS
CSC655	Tutorial
CSC656	Seminar

Elective 2: (Select any one from CSC 631 to CSC635)

Course Code	Course Title
CSC631	Open CV With Python
CSC632	Speech Processing
CSC633	Theory Of Computation
CSC634	Human Computer Interaction
CSC635	Biometric and Security
CSC657	Tutorial
CSC658	Seminar

Criteria for Assessment of Training Field work or Tutorial (Credit: 01)

- Tutorial consists of a report on **each UNIT of said course where tutorial is assigned and it must** contain the review on concern UNIT along with new findings by the student, problem/s and challenges, interpretation and discussion & conclusion. (At least one problem from each UNIT should be implemented 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.*

Final date of Submission: will be declared by the course coordinator/teacher/guide

Criteria for Assessment of Seminars (Credit: 01)

- Candidates will have to submit the topic name and a page summary of seminar decided by candidate and the course coordinator. After approval from the course coordinator they have to prepare the seminar report and submit for final confirmation and certification.

  Internal Evaluation: Minimum two seminar Reviews on the decided topic which will be presented in the final Exam.

  Final date of Seminar report submission: **will be declared by the course coordinator**

Course Code	Course Title	No. of Credits	No. of Hours/week	Total Marks (External)	Total Marks (Internal)
CSC659	Dissertation	07	14	80	20

Minimum Standard and procedure for M. Phil Degree (O.187)

The Women candidate and person with disability (more than 40% disability) may be allowed a relaxation of two year for M. Phil on the maximum duration. The women candidate will be provided maternity leave once in the entire duration of M. Phil for up to 240 days.

Prior to the submission of the dissertation the scholar shall make a presentation in the department before the Departmental committee / research advisory committee of the department concerned which shall also be open to all faculty members and other research scholars. The feedback and comments obtained may be suitably incorporated into the draft of dissertation.

M. Phil Candidate shall publish at least one research paper in a UGC approved & referred journal's list (Scopus / SCI / SCIE for science student), before submission of the dissertation for adjudication and produce evidence for the same in the form of acceptance letter or the reprint.

Final dissertation must be submitted along with certificate of completion of course work. Foreign student should submit certificate of completion of Communicative English Speaking Course along with certificate of completion of course work.

Dissertation shall be submitted in the form of hard bound copies (2) two, the copies of the dissertation shall be submitted in two compact Discs (C.D.).

The final dissertation shall be presented in accordance with the following specification:-

1. The paper used for printing shall be of A4 size executive bond.
2. Printing shall be in a standardized form both side of the paper and in 1.5 lines space

3. A margin of 1.5 inches shall be on the left hand side.
4. Font size should be 12 New Times Roman for English and DVBTT- Surekh in ISM for Devnagari.
5. The card for cover shall not be more than 330 GSM.
6. The title of the dissertation, name of the candidate, degree, name of the guide, place of the research and the month and year of submission shall be printed on the title page and on the front cover.

7. The hard bound dissertation cover shall be of black color. Spine of the binding (side cover) should mention 'M. Phil dissertation' on the top, name of the candidate and month and the year, the specification is shown in H (O.187)
8. Do not use plastic papers/sheets in dissertation.
The dissertation shall include a certificate of the guide Appendix –**I (**O.187) and a declaration by the candidate appendix **–J (**O.187) that the work reported in the dissertation has been carried out by the candidate himself / herself and that the material from other sources, if any, his duly acknowledged.

In addition to the copies of the dissertation mentioned above the candidate shall submit the following documents:-

i. In case a dissertation is written in a language other than English, a summary of the dissertation in 1000 words in English be submitted in five copies, for abstracting purpose.
ii. No due certificate from concerned department / central library of University, hostel, account section of university.
iii. The candidate shall submit to the Deputy Registrar (P.G. Section) two copies of his/her dissertation and produce acknowledgement of the receipt of the dissertation by the research guide and the head, place of research.

DISSRTATION EVALUATION PROCESS

i. The progress of the work (at least one) to be presented in front of concerned department faculty. Thereafter the head of the department and concerned guide shall forward progress report to the Deputy Registrar, PG section.
ii. The M. Phil dissertation of the research scholar shall be evaluated by his/her research supervisor and an External examiner who shall be from outside the University jurisdiction.
iii. Research and Recognition Committee / RAC shall finalize names of three experts, from outside Dr. Babasaheb Ambedkar Marathwada University jurisdiction. A panel of recognized experts who are research guides in the relevant subject shall be approved by the competent authority. The list of examiner's/referee's shall be maintained by the competent authority for the consideration of the RRC/RAC.
iv. After the approval of the panel of the examiners by RRC/ RAC. The Hon.Vice chancellor shall choose one examiner from the approved panel to examine the dissertation. The Deputy Registrar of the P.G. section shall forward the dissertation to the examiner within a week from the date of the receipt of the acceptance letter of the examiner after the submission of the dissertation whichever is later. If an examiner does not accept the invitation within 30 days from the date of dispatch of the invitation letter, the deputy registrar shall send an invitation letter, to the next examiner on the panel.

v. The External Examiners shall independently send their reports to the office of the deputy registrar P.G. within 30 days from the date of receipt of the dissertation (the Report sent by Fax or email by using the "post script" will be accepted). If an examiner fails to do so, Deputy Registrar shall send him/her reminder immediately after the expiry of the said period and request him / her to submit the report within 30 days. If the examiner concerned fails to comply even within the extended period the Hon'ble Vice-Chancellor shall cancel his / her appointment forthwith and invite the next examiner from the approved panel to evaluate the dissertation. In the event of request from examiner for late submission of the report; or receipt of the report after the appointment has been cancelled, or the loss of the report or postal delay etc, the Hon'ble Vice-Chancellor shall take an appropriate decision in the interest of the candidate concerned.

vi. The positive report received from the external examiner and the research guide (Internal examiner) shall be immediately forwarded to the concerned University department head and guide at the place of research who after ascertaining that the reports are favorable, shall arrange for the open viva- voce defence of the dissertation at the earliest dates suitable for internal examiner and the external examiner. The Deputy Registrar shall make the reports available to the candidates, the research guide and the Chairperson/ Head at least a day before the date of the open Viva-voce.

vii. In case external examiners give un-favorable report then the Hon'ble Vice-Chancellor shall get dissertation examined by an additional examiner from the panel of examiners approved by R.R.C. / R.A.C. If the additional examiner too gives an unfavorable report the candidate will be declared to have failed.

OPEN VIVA-VOCE DEFENCE OF THE DISSERTATION

a. The day, date, time and place of the open viva-voce defense of the dissertation shall be notified by the head of the place of the research at least 8 working days in advance. Normally the open viva-voce defence of the dissertation shall be arranged in the University Department.
b. The defence of the dissertation shall take place in the presence of the guide (internal examiner) external examiner and Chairperson. They shall jointly evaluate the performance of the candidate. In case of the dispute the Hon'ble Vice-Chancellor shall take an appropriate decision.
c. The examiners present for the open viva-voce defence of the dissertation shall submit to the Deputy Registrar, P.G. Section their final consolidated report along with the reply given to the queries raised by the external examiners in the written form duly signed and accepted by the members of the open viva-voce panel (Appendix- **K**) (O.187), and list of the persons attended the open defence (minimum 15) (Appendix- **L**) (O.187), immediately after open viva voce is over.
d. The University shall issue the Notification on the same day, certifying to the affect that the Degree has been awarded in accordance with the regulations issued by the UGC. as per the Notification dated 05th May, 2016 and subsequent Gazette of India published on 05th July, 2016.

Depository with the University Grants Commission: Following the successful evaluation process and announcement of the award of the M. Phil Degree, the University shall submit a soft copy of the dissertation to the UGC. within a period of 30 days for hoisting the same in INFLIBNET.

Detailed Syllabus

Semester-I

1. Research Methodology

Subject Reference no	**CSC601**	**Subject Title**	**Research Methodology**
No of Credits	**6 Theory, 1Seminar, 1Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**6Theory, 4 Practical**	**External (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:
The research methodology module is intended to assist students in planning and carrying out research projects. The students are exposed to the principles, procedures and techniques of implementing a research project. The course starts with an introduction to research and carries through the various methodologies involved. It continues with finding out the literature using domain and ends with knowing the tools used for data analysis in various systematically way.

Course Outline:
Unit 1: Description: Introduction - 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 processes - criteria of good research - defining research problem - selecting the problem - necessity of defining the problem - techniques involved in defining a problem – research design - meaning of research design - need for research design - features of good design - different research designs - basic principles of experimental design. Thesis Writing: The preliminary pages and the introduction - the literature review - methodology - the data analysis - the conclusions - the references (IEEE format).

Unit 2: Review of Literature: Significance of review of literature – source for literature: books - journals – proceedings - thesis and dissertations -unpublished items. Database – SciFinder – Scopus - Science Direct – Searching research articles - Citation Index - Impact Factor - H-index etc,
Classification, analysis and presentation of data. Statistical treatment of collected data. Arithmetic mean, geometric mean, standard deviation, errors, propagation of errors, statistical distribution laws. Plagiarism and Research Ethics

Unit 3: Quantitative Techniques: General steps required for quantitative analysis - reliability of the data - classification of errors – accuracy – precision – statistical treatment of random errors - the standard deviation of complete results – error proportion in arithmetic calculations - uncertainty and its use in representing significant digits of results - confidence limits - estimation of detection limit.

Unit 4: R as a Research Tool: Basics R features; introduction to the main data types and visualization, Introduction to functions. More on lists and data frames, Programming structures: relational and logical operations; flow control, statistical models in R, Data Analytics Case Study

Unit 5: Intellectual Property Right: General Introduction, Patents and copyrights, Design Patents & copyrights, Patent drafting, patent claims and specifications, trademarks, trade integrated circuit. Patent Life and Geographical Boundaries, Utilization of Intellectual Patents, Patent Search, Patent Acts & Rules, Legal Decision making process, Ownership of Patents, Author & ownership of Copyright, Licensing of Copyrights, Infringement of Copyrights and patents, Remedies & Actions for Infringement of Copyrights IPR as Protection Strategy. Patent cooperation treaty (PCT), Indian & US Patent Acts & Latest Amendments.

Recommended Books:

1. Research Methodology (Second Revised Edition) – C.R.Kothari; New Age Publishers, 2004
2. Thesis and Assignment Writing – J Anderson, B.H. Dursten and M. Poole, Wiley Eastern (1977).
3. Advanced R by Hadley Wickham
4. The Art of R Programming by Norman Matloff

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. Pattern Recognition

Subject Reference no	**CSC602**	**Subject Title**	**Pattern Recognition**
No of Credits	**3Theory , 1 Seminar , 1 tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**3 Theory, 4 Practical**	**External (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: Definitions**,** data sets for Pattern Recognition, Different paradigms of Pattern Recognition, Representation of Patterns and Classes, Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, discrete features

Unit 2: Feature Selection, Maximum Likelihood and Bayesian Estimation: Feature selection: Problem statement and Uses; Algorithms - Branch and bound algorithm, sequential forward / backward selection algorithms, (l,r) algorithm; Probabilistic separability based criterion functions, interclass distance based criterion functions

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.

References:

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 Outcome:

- 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

Semester-II

Elective 1

1. Advance Inage Processing

Subject Reference no	**CSC621**	**Subject Title**	**Advanced Image Processing**
No of Credits	**3Theory, 1Seminar, 1Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**3 Theory, 4 Practical**	**External (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.

Course Outline:

Unit 1: Introduction: What Is Digital 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 Sampling and Quantization, Some Basic Relationships 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, Pseudocolor 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, 3D reconstruction 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

References:

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	**3 Theory, 1Seminar,1Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**3Theory, 4Practical**	**External (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 Objective:

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, 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. **Advanced techniques, Data Mining software and applications** Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing). Bayesian approach to classifying text Web mining: classifying web pages, extracting knowledge from the web Data Mining software and applications

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

References:

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

3. Natural Language Processing

Subject Reference no	**CSC623**	**Subject Title**	**Natural Language Processing**
No of Credits	**3 Theory, 1 Seminar,1 Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**3Theory, 4Practical**	**External (Semester Exam)**	**80%**

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

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 The Chomsky hierarchy

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. **Word Modeling: Statistical Approaches and Part of Speech Tagging:** HMM Tagging, Statistical Transformation,Rule-Based Tagging, Precision, Recall, Accuracy

Unit 5: Machine Translation and Comparison with some western computational grammars: Introduction, brief history, Language Accessor etc, Lexical functional grammar, Introduction, Computational Aspects etc. **Insights of few Applications of NLP**: Information Retrieval, Information Extraction, Speech Recognition Systems, Machine Translation

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.

References:

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

4. Digital Signal Processing

Subject Reference no	**CSC624**	**Subject Title**	**Digital Signal Processing**
No of Credits	**4 Theory, 1Seminar, 1Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**4 Theory, 4 Practical**	**External (Semester Exam)**	**80%**

Prerequisite: Before attending this course, students must have basic knowledge about mathematics, set theory, linear algebra, calculus and logic.

Objective: To learn methodology to analyze signals and systems

- Study transformed domain representation of signals and systems
- Design of filters as DT systems
- To get acquainted with the DSP Processors and DSP applications

Course Contents

Unit 1: Introduction to Digital Signal Processing: System, ASP-analog signal processing, Digital system, Advantage of DSP over ASP.

Classification of Signal: Classification of signal, Multichannel and Multidimensional signal, Continuous time and discrete time signal, continuous valued and discrete valued signal, Deterministic and random signal, periodic and a periodic signal, symmetric and anti-symmetric signal, energy signal and power signal, characteristics of continuous time and discrete time signal, discrete time signal representation, standard test signal.

Unit 2: Signal and System: Introduction to analog to digital conversion, Aliasing, sampling theorem, anti-aliasing filter, reconstruction of signal, quantization of continuous signal, Classification of system, discrete time system, linear time invariant system(LTI), convolution, stability criteria of LTI system, causality criteria of LTI system**,** cross correlation**,** autocorrelation**,** properties of correlation**,** application of correlation**.**

Unit 3: Signal Transformation: Introduction of Fourier, Fourier representation of four signal class, Fourier series, Fourier transforms, properties of Fourier transform, convergence of Fourier transform, inverse Fourier transform, Definition of DFT, Inverse discrete Fourier transform, DFT properties, DFT frequency response characteristics, relationship of DFT to other transform, Z transform, Complex Z plane, Region of convergence (ROC), properties of Z transform, relationship of FFT and Z transform, inverse Z transform.

Unit 4: Fundamentals of Filter Design: Introduction to digital filter, filter design steps, structure of IIR filter , IIR filter design, impulse invariant method, bilinear transformation method, analog filter for designing digital filter, designing high pass, band pass and band stop filter, structure of FIR filter, FIR filter design, FIR filter specification, FIR filter design method, finite precision effect.

Unit 5: Applications of DSP : Audio processing, Image formation and display, Linear Image Processing, Spatial Imaging Techniques, Neural Networks, Data Compression.

Reference Books:

1. Digital Signal Processing By N G Palan, Techmax Publications Pune.
2. Digital Signal Processing: Principles, Algorithms & Applications -J.G.Proakis & D.G.Manolokis, 4thed,PHI.
3. DSP – A Pratical Approach – Emmanuel C.Ifeacher, Barrie. W. Jervis, 2 ed., Pearson Education.
4. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, 2006
5. Babu R., "Digital Signal Processing", 4th Edition, Scitech Publications, ISBN 978-81-8371-081-7
6. Mitra S., "Digital Signal Processing: A Computer Based Approach", Tata McGraw-Hill,1998, ISBN 0-07-044705-5

Course Outcomes:

After completing this course, students will be able to:

- Good opportunity to explore and learn more specialized field of Computer science, electrical engineering and automobile industries.
- It provides the students the fundamentals of signal analysis. Signal analysis is a basic tool in many courses offered in the M.Sc. program such as Human Computer Interaction, Pattern Recognition, Fuzzy logic, and neural networks.
- It is important in fulfilling the need for computer engineers who can understand the DSP tools in the marketplace.
- MATLAB is integrated into this course. In projects and appropriate problems, students are asked to do the calculations using MATLAB.
- Students will learn numerous programming tools for design and implementations of filtering algorithms.

5. Remote Sensing and GIS

Subject Reference no	**CSC625**	**Subject Title**	**Remote Sensing and GIS**
No of Credits	**3 Theory, 1Seminar, 1Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**3Theory, 4Practical**	**External (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 Objective: The course is designed to fulfill the following objectives

1. To acquire skills in storing, managing digital data for planning and development.
2. To provide exposure to students in gaining knowledge on basic concepts and applications leading to modeling of natural resources management using Remote Sensing

Unit 1: Basics of Remote Sensing, Principles of Remote sensing, History of Remote sensing, Remote sensing in India, Electromagnetic Radiation and Electromagnetic Spectrum, EMR quantities: Nomenclature and Units
Thermal Emission of Radiation, Radiation Principles (Plank's Law, Stephen Boltezman law) Interaction of EMR with the Earth Surface (Wien's Displacement law, Kirchoffs Law) Spectral signature, Reflectance characteristics of Earths cover types, Remote sensing systems.

Unit 2: Platforms and Sensors Platforms, Types of sensors, resolutions sensor, Passive and Active Sensors, Optical sensors, Classification of RS, Selection of Sensor Parameter, Spatial Resolution, Spectral Resolution, Radiometric Resolution, Temporal Resolution. Satellite missions: Landsat series, SPOT series, IRS, Metrological satellites

Unit 3: Microwave Region, Thermal, Multispectral and Hyperspectral Sensing: Characteristics of EM radiation in microwave region, passive and active Microwave sensors. Introduction - Electromagnetic spectrum in thermal inferred. Across-Track & Along-Track Scanning. Operating Principles: Across-Track Multispectral Scanners, Across-Track Thermal Scanning. Thermal Radiation Principles, Interpreting Thermal Scanner Imagery. Geometric Characteristics of Across-Track & Along-Track Scanner Imagery. Radiometric Calibration of Thermal Scanners. Temperature Mapping with Thermal Scanner Data, FLIR Systems, Hyperspectral Sensing, Thermal properties of vegetation, soils, water and snow in thermal domain.

Unit-IV Interpretation of Remote Sensing Images: Types of interpretation, Interpretation Phase. Visual Interpretation, Criteria for visual interpretation, Elements for visual analysis. Digital image processing enhancement and correction: Structure, Media and data organization, Equipments, visual enhancement, image correction, Radiometric and Geometric corrections. Digital Image Classification.

Unit-V Remote Sensing and GIS: GIS Introduction, Need for GIS, Data Model, Data Entry, Data Analysis, GPS, and Remote Sensing as input for GIS. Integration of Satellite Images and GIS. Spatial Data Infrastructure.

Text Books

1. Fundamentals of Satellite Remote Sensing, Emilio Chuvieco, Alfredo Huete (2010), CRC Press, Taylor & Francis Group.
2. Remote Sensing and Image Interpretation. 4th ed. Lillesand, T.M., Kiefer, R.W. and Chipman.J.W. 2008. New York: John Wiley & Sons.
3. Fundamentals of Remote Sensing, George Joseph (2004), Universities Press (India) Private Limited.
4. Remote Sensing Models and Methods for Image Processing, 3rd ed, Robert A. Schowengerdt, Academic Press is an imprint of Elsevier, 2007.

Reference Books

1. Remote Sensing of the Environment - an Earth Resource Perspective 2nd ed. Jensen, J.R. 2007. Upper Saddle River, NJ, Prentice Hall.
2. Remote Sensing Principles and Interpretation, Floyd, F. Sabins, Jr: Freeman and Co., San Franscisco, 1978.
3. Manual of Remote Sensing Vol. I&II, 2nd Edition, American Society of Photogrammetry.
4. Remote Sensing: The quantitative approach, P.H. Swain and S.M. Davis, McGraw Hill.
5. Introductory Digital Image Processing: A remote sensing perspective, John R. Jensen, P. Hall.
6. Imaging Radar for Resource Survey: Remote Sensing Applications, 3, W Travelt, Chapman & Hall.
7. Remote sensing Notes –Edited by Japan Associates of Remote sensing- JARS 1999
8. Introduction to Remote Sensing, Campbell James, Taylor & Francis London.
9. Photogrammetry and Remote Sensing (2000), Lecture notes, Module I, IIRS
10. Remote Sensing, Agarwal C.S. and Garg, P. K. (2000): A. H. Wheeler and Co. Ltd., New Delhi.

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. Open CV With Python

Subject Reference no	**CSC631**	**Subject Title**	**Open CV With Python**
No of Credits	**3Theory, 1Seminar, 1Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**3Theory, 4 Practical**	**External (Semester Exam)**	**80%**

Prerequisite:
The student should have fundamental skills on basic image and video processing, programming experience of C++/Java be an added advantage. Student should have prelimanary skills on object oriented python programming.

Course Objective:
The objective of this course is to discover the power of OpenCV and Python for the demand of computer vision expertise in exponentially growing industry. OpenCV which is the most well supported open source computer vision library that exists today! Using it in Python is just fantastic as Python allows us to focus on the problem at hand without being bogged down by complex code. In this course student will be able to learn

- Key concepts of computer Vision & OpenCV.
- To perform image manipulations such as transformations, cropping, blurring, thresholding, edge detection and cropping.
- To segment images by understanding contours, circle, and line detection. You'll even learn how to approximate contours, do contour filtering and ordering as well as approximations.
- Use feature detection (SIFT, SURF, FAST, BRIEF & ORB) to do object detection.
- Implement Object Detection for faces, people & cars.
- Extract facial landmarks for face analysis, applying filters and face swaps.
- Implement Machine Learning in Computer Vision for handwritten digit recognition.
- Implement Facial Recognition.
- Implement and understand Motion Analysis & Object Tracking.
- Use basic computational photography techniques for Photo Restoration (eliminate marks, lines, creases, and smudges from old damaged photos).

Course Outline:
Unit 1: Introduction: Introduction to Computer Vision and Open CV, Downloading and Installing Open CV, getting started with OpenCV, Simple Image Transformations, Dealing and Writing with Files. Open CV primitive types, CvMat Structure, Image data Structures, Matrix and Image Operators, Integrated Performance Primitives.

Unit 2: Handling Files, Cameras and GUI: Reading and Writing Image File Data, Converting between Image and raw bytes, Reading and Writing Video Files, Capturing camera Frames, Displaying Camera Frames in Video. **Filtering Images**: Channel Mixing by RC, RGV and CMV Color Spaces, Curves, Highlighting Edges, working with kernels, **Image Transforms:** Overview, convolution, Gradients and Sobel Derivatives, Edge detection operators (Lapacian, Canny), Hough Transform, Affine Transform (Stretch, Shrink, Wrap & Rotate), CartToPolar, PolarToCart,

logPolar, Discrete Fourier Transform, Discrete Cosine Transform, Distance Transform, Histogram Equalization

Unit 3: Histogram Matching & Contours: Basic Histogram, Manipulators with Histogram, Contour memory usage, sequences, contour finding & Matching contours, **Detecting Foregrounds/Backgrounds and Depths**: Evaluating captured data, creating masks, creating disparity maps, Image parts & Segmentation: Parts and Segments, Background Subtraction, Watershed Algorithm, Mean shift Segmentation, Image repair by Inpainting.

Unit 4: Camera Calibration: Camera Model, Calibration, Un-distortion, putting calibration all together, Rodrigues Transform. **Tracking Objects**: Haar Cascades, Getting data from Haar Cascades, tracing, cutting and pasting rectangles on objects, tracking objects, **Tracking Motion:** Basics of tracking, Corner finding, Subpixel corners, invariant features, Optical Flow, Mean shift & Cam shift tracking, Motion Templates, Estimators, Condensation Algorithm.

Unit 5: Projection and 3D Vision: Projections, Affine & Perspective Transformation, 3D pose estimation, Stereo Imaging, Estimating Structure from Motion, Fitting lines in two & Three Dimensions, **Machine Learning:** Installing and Configuring Machine Learning Library, Mahalanobis Distance, K-Means, Normal Bayes Classifier, Support Vector Machine, Binary Decision Trees, Boosting, Random Trees.

Case Study: Tracking Faces with Haar Cascades, Number plate Recognition, Head Pose Estimation

Books:

1. Learning Open CV, Gary Bradski and Adrian Kaehler, O'Reilly Publications
2. Mastering OpenCV with Practical Computer Vision Projects , PACKT Publishing, Open Source
3. OpenCV Computer Vision with Python, Joesph Howse, PACKT Publishing, Open Source

Tutorial Exercise:

Minimum two practical's on each unit and one minor project to be designed in light of the research domain selected by the students if it is related to Computer Vision.

OpenCV Platforms:

1. http://SourceForge.net/projects/opencvlibrary
2. https://pypi.python.org/pypi/opencv-python

Course Outcome:

- Build complex computer vision applications using the latest techniques in OpenCV
- Understanding how to use Machine Learning & Augmented Reality in computer vision
- Use several methods of object detection and facial analysis to create amazing apps
- Program in Python
- Use Numpy in Python

2. Speech Processing

Subject Reference no	**CSC632**	**Subject Title**	**Speech Processing**
No of Credits	**3Theory, 1Seminar, 1Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**3Theory, 4 Practical**	**External (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.

Objective: 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; and control of speech synthesizers. In the required projects, students will implement speech analysis software and build a small speech recognition or compression system.

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 predictive 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

Textbook:

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. Theory of Computation

Subject Reference no	**CSC633**	**Subject Title**	**Theory of Computation**
No of Credits	**3 Theory, 1Seminar, 1Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**3 Theory, 4 Practical**	**External (Semester Exam)**	**80%**

Prerequisite: students should have the knowledge of Discrete mathematics.

Course Objective:

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.

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.

Text 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

NB. : 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.

4. Human Computer Interaction

Subject Reference no	**CSC634**	**Subject Title**	**Human Computer Interaction**
No of Credits	**3 Theory, 1Seminar, 1Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**3 Theory, 4 Practical**	**External (Semester Exam)**	**80%**

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

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 Contents

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. Biometric and Security

Subject Reference no	**CSC635**	**Subject Title**	**Biometric and Security**
No of Credits	**3 Theory, 1Seminar, 1Tutorial**	**Assignment/ Sectionals (Internal)**	**20%**
Total Contact Hrs/Week	**3Theory, 4 Practical**	**External (Semester Exam)**	**80%**

Prerequisite: UG level concepts of Number Theory

Objective: To learn:

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

Course Outline:

Unit 1: 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.

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 Outcome: Upon completion of the subject, students will be able to:

- Professional/academic knowledge and skills
- understand fundamental issues and challenges for network security
- get familiar with the basic techniques for cryptography including conventional encryption, public-key cryptography, message authentication, hash functions and digital signature
- understand the key issues and importance of biometric systems for security concerns;
- recognize physical and behaviour biometric characteristics;
- Apply biometric technology for different security applications.

IQAC Cell

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